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John Dalton, D.C.L., F.R.
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RESEARCHES

IN

ZOOLOGY,

ILLUSTRATIVE OF THE

MANNERS AND ECONOMY OF ANIMALS;

WITH DESCRIPTIONS OF

NUMEROUS SPECIES NEW TO NATURALISTS;

ACCOMPANIED BY PLATES.

BY

JOHN BLACKWALL, F. L. S.

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OF THE
LITERARY AND PHILOSOPHICAL, AND NATURAL HISTORY SOCIETIES
OF MANCHESTER, &c.

LONDON:

PUBLISHED BY SIMPKIN AND MARSHALL, STATIONER'S-COURT, LUDGATE-HILL;
SHERWOOD AND CO. PATERNOSTER-ROW; AND J. PIGOT AND CO.
NATIONAL DIRECTORY OFFICE, BASING-LANE, BREAD-STREET, CHEAPSIDE.

1834.

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TO

JOHN DALTON, D.C.L., F.R.S.

PRESIDENT OF THE LITERARY AND PHILOSOPHICAL SOCIETY,

MANCHESTER;

MEMBER OF THE ROYAL ACADEMY OF SCIENCES, PARIS;

OF THE ROYAL ACADEMIES OF SCIENCE OF BERLIN AND OF MUNICH;

OF THE NATURAL HISTORY SOCIETY OF MOSCOW, &c. &c.

This Volume is inscribed,

AS A TESTIMONY OF RESPECT FOR THE TALENT WHICH HE HAS SO SUCCESSFULLY EMPLOYED IN EXTENDING THE BOUNDS OF PHYSICAL SCIENCE, AND OF ESTEEM FOR THE DISINTERESTEDNESS WHICH HE HAS UNIFORMLY MANIFESTED IN THE PROMULGATION OF HIS IMPORTANT DISCOVERIES.

BY HIS OBLIGED FRIEND,

THE AUTHOR.

PREFACE.

HAVING been repeatedly urged to publish collectively my Researches in Zoology, comprised in numerous papers printed in the TRANSACTIONS OF THE LINNEAN SOCIETY OF LONDON; the MEMOIRS OF THE LITERARY AND PHILOSOPHICAL SOCIETY OF MANCHESTER; the PHILOSOPHICAL MAGAZINE; the ZOOLOGICAL JOURNAL, and other scientific publications; in compliance with those solicitations, and with the permission of the learned bodies referred to above, I now submit them to the public, with such additions and emendations as subsequent investigations have enabled me to effect.

It may be proper to remark, that the materials of which the present volume is composed have been collected, for the most part, in the country extending round Manchester to the distance of five or six miles, during intervals of relaxation from more important avocations; and, independantly of local considerations, it is hoped that they will be found to contain information on various subjects interesting to the general reader and to the natural philosopher.

OAKLAND, DENBIGHSHIRE,
July 12*th*, 1834.

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RESEARCHES IN ZOOLOGY.

ON THE

MIGRATION OF BIRDS.

AN accurate and comprehensive history of the Periodical Birds may now be considered as one of the greatest desiderata in ornithology. Hitherto, little has been done to elucidate the manners and economy of this interesting portion of the feathered tribes, as connected with their periodical appearance and disappearance; for although much has been written on the subject, few facts of any considerable importance have been ascertained; and even those few lie scattered through the writings of such various authors, and are so blended with what is erroneous or merely conjectural, that it is no easy task to distinguish and collect them ; consequently, our knowledge of the circumstances which regulate the motions of the numerous species of Periodical Birds is still very imperfect ; and we are almost entirely ignorant of the places of their retreat, and of the mode of their existence in those retreats. Whether, when they withdraw, they depart from those districts and countries in which they cease to appear, or whether they conceal themselves, and remain in a state of torpidity, has not yet been positively determined ; and opinions must continue to be divided on the subject, so long as authors indulge in fanciful speculations, instead of collecting and arranging well-authenticated facts, from which alone legitimate conclusions can be deduced.

The accumulation of facts, then, appears to be the most important object to be attained at present, and my principal motive for giving publicity to the following tables and remarks, is the hope that they may be found to contribute, in some degree, to increase our scanty stock of information on this obscure branch of natural history.

It is remarkable, that almost all the catalogues of Periodical Birds with which I am acquainted, have been formed from observations made in the South of England. This circumstance is certainly calculated to give additional interest to the following tables, made in so northern a county as Lancashire. In forming them, I have ventured to deviate a little from the usual mode of arrangement, having separated those birds which are irregular in the times of their appearance and disappearance, and those species also which are periodical in particular districts only, from the regular Summer and Winter Birds, and have classed them under appropriate heads. I have, however, retained the Wheatear, Whinchat, Stonechat and Pied Wagtail among the Summer Birds, and the Snipe and Wild Duck among the Winter Birds; for though individuals of the first four species frequently remain through the winter in the southern counties, and though numbers of Snipes and Wild Ducks breed with us annually, yet the periodical appearance and disappearance of a very large proportion of those birds cannot, I think, be questioned. Many of the larger species of Aquatic Birds included in the tables are rarely seen in the vicinity of Manchester, except during severe frosts, or after violent storms of wind; of course their appearance is uncertain, and their stay is generally short.

The remarks consist chiefly of details of such circumstances relative to the migration of birds as have fallen under my own observation, and of conclusions drawn from them, and from an attentive consideration of the facts recorded by others.

TABLES

OF THE

Various Species of Periodical Birds observed in the Neighbourhood of Manchester.

The Periodical Birds may, with propriety, be arranged under four distinct heads.

1st. The Summer Birds, or those species which appear during the spring months and retire in autumn.

2nd. The Winter Birds, or those species which appear during the autumnal months and withdraw in spring.

3rd. Birds which are irregular in the times of their appearance and disappearance.

4th. Birds which are partially periodical, retiring in particular districts only.

The tables contain those species of Periodical Birds which visit the neighbourhood of Manchester, classed according to the above method; the times of their arrival and departure, taken at an average of fifteen years' observations, commencing with 1814 and terminating with 1828, and the general mean temperature of those days on which they have appeared and disappeared during that period, found from the extremes indicated by a pair of Rutherford's horizontal self-registering thermometers, exposed to the open air in a shady situation, being also given.

It is proper to intimate that I have employed the nomenclature of the second edition of M. Temminck's *Manuel d' Ornithologie* throughout the volume, in treating upon European Birds; but that as regards extra-European species, the names, for the most part, are accompanied by the authorities I have adopted.

TABLE I.

Periodical Summer Birds.

BIRDS.	Appear.	Tempe-rature.	Disappear.	Tempe-rature.
Pied Wagtail—Motacilla alba	Mar. 13.	49°	Oct. 18.	49°
Wheat-ear—Saxicola Œnanthe	April 6.	43	Sept. 21.	53
Sand Martin—Hirundo riparia	,, 9.	48	,, 15.	55
Wryneck—Yunx Torquilla	,, 11.	45	,, 9.	55
Yellow Wren—Sylvia Trochilus......	,, 11.	48	,, 17.	56
Redstart—Sylvia Phœnicurus	,, 13.	50	,, 14.	59
Yellow Wagtail—Motacilla flava......	,, 13.	47	,, 16.	54
Lesser Fieldlark—Anthus arboreus ...	,, 14.	51	,, 13.	55
Swallow—Hirundo rustica	,, 15.	50	Oct. 7.	53
Cuckoo—Cuculus canorus............	,, 20.	47	June 27.	59
House Martin—Hirundo urbica	,, 25.	47	Oct. 10.	53
Whinchat—Saxicola Rubetra	,, 26.	52	Sept. 18.	55
Black-cap—Sylvia Atricapilla	,, 27.	48	,, 7.	60
Pied Flycatcher—Muscicapa luctuosa..	,, 27.	44	,, 4.	55
White-throat—Sylvia cinerea	,, 28.	52	,, 15.	55
Wood Wren—Sylvia Sibilatrix	,, 28.	50	,, 6.	57
Stonechat—Saxicola Rubicola	,, 28.	52	Oct. 24.	51
Lesser White-throat—Sylvia Curruca..	,, 30.	55	Sept. 7.	58
Sedge Warbler—Sylvia Phragmitis....	May 3.	53	,, 10.	61
Pettychaps—Sylvia hortensis	,, 4.	52	,, 10.	60
Sandpiper—Totanus Hypoleucos	,, 4.	58	,, 10.	56
Grasshopper Warbler--Sylvia Locustella	,, 5.	52	,,	
Swift—Cypselus murarius............	,, 8.	50	Aug. 17.	58
Spotted Flycatcher—Muscicapa grisola.	,, 11.	51	Sept. 18.	58
Land Rail—Gallinula Crex	,, 13.	53	Oct. 7.	49
Goatsucker—Caprimulgus Europœus..	,, 15.	53	Sept. 8.	57.
Red-backed Shrike—Lanius Collurio ..	,, 19.	54	,, 13.	55
Lesser Pettychaps—Sylvia Hippolais ..			,, 21.	56
Spotted Gallinule—Gallinula Porzana.			Oct. 15.	45
Quail—Perdix Coturnix				
Hobby—Falco Subbuteo				
Turtle Dove—Columba Turtur				
Dottrel—Charadrius morinellus				
Common Tern—Sterna Hirundo				
Lesser Tern—Sterna minuta				
Black Tern—Sterna nigra............				
Puffin—Mormon Fratercula				

TABLE II.

Periodical Winter Birds.

BIRDS.	Appear.	Temperature.	Disappear.	Temperature.
Snipe—Scolopax Gallinago	Sept. 10.	58°	April 5.	45°
Jack Snipe—Scolopax Gallinula	Oct. 1.	56	„ 3.	44
Water Rail—Rallus aquaticus	„ 7.	52	„ 12.	44
Great Snipe—Scolopax major	„ 12.	58		
Redwing—Turdus iliacus	„ 13.	52	Mar. 29.	46
Grey-lag Goose—Anas Anser	„ 17.	52	April 2.	43
Short-eared Owl—Strix brachyotos....	„ 20.	46		
Mountain Finch—Fringilla Montifringilla ..	„ 21.	48	April 10.	40
Woodcock—Scolopax Rusticola	„ 21.	50	Mar. 29.	43
Wild Duck—Anas Boschas	„ 21.	52	„ 24.	41
Smew—Mergus albellus	„ 23.	38		
Goosander—Mergus Merganser	„ 24.	40		
Fieldfare—Turdus pilaris	„ 27.	45	Mar. 31.	41
Hooded Crow—Corvus Cornix	„ 30.	44	April 13.	45
Green Sandpiper—Totanus Ochropus. .			May 7.	63
Snow Bunting—Emberiza nivalis			Feb. 27.	38
Greenshank—Totanus Glottis				
Godwit—Limosa rufa................				
Hooping Swan—Anas Cygnus				
Bernacle Goose—Anas leucopsis				
Golden-eye—Anas Clangula				
Pochard—Anas ferina				
Widgeon—Anas Penelope				
Teal—Anas Crecca..................				
Little Auk—Uria Alle				

TABLE III.

Birds which are irregular in the times of their appearance and disappearance.

BIRDS.	Appear.	Temperature.	Disappear.	Temperature.
Great Cinereous Shrike—Lanius Excubitor	April 21.	49°		°
Hoopoe—Upupa Epops	May 16.	58	Sept. 26.	53
Crossbill—Loxia Curvirostra	Aug. 5.	59	Nov. 19.	43
Siskin—Fringilla Spinus	Nov. 24.	39		
Haw Finch—Fringilla Coccothraustes..	Dec.			
Bohemian Wax-wing—Bombycivora garrula	„			
Golden Oriole—Oriolus Galbula......				
Rose-coloured Pastor—Pastor roseus ..				
Olivaceous Gallinule—Gallinula pusilla				

TABLE IV.

Birds which are partially Periodical.

BIRDS.	Appear.	Temperature.	Disappear.	Temperature
Throstle—Turdus musicus	Jan. 23.	39°	Nov. 14.	45°
Starling—Sturnus vulgaris	Feb. 12.	41	Oct. 16.	49
Common Bunting—Emberiza Miliaria.	Marc 6.	38	„ 16.	56
Reed Bunting—Emberiza Schœniclus..	„ 10.	46	„ 4.	55
Greenfinch—Fringilla Chloris	„ 14.	48	„ 18	54
Lapwing—Vanellus cristatus	„ 27.	49	Sept. 29.	57
Lesser Redpole—Fringilla Linaria	April 10.	47	Oct. 21.	47
Mountain Linnet—Fringilla montium..	„ 22.	50	Sept. 17.	56
Grey Wagtail—Motacilla Boarula	Sept. 7.	57	April 11.	44
Merlin—Falco Æsalon	Oct. 13.	49	„	
Ring Ouzel—Turdus torquatus	„ 19.	49		

Remarks.

The gradual increase of temperature in spring, and its decrease in autumn, are circumstances which seem to be so closely connected with the appearance and disappearance of the Periodical Birds, that they have long been regarded as the primary causes of those phenomena. In reflecting on this very generally received opinion, it occurred to me, that I had never met with any attempt to ascertain how nearly the temperature at the time of the appearance of the Periodical Birds coincides with the temperature at the time of their departure; and, as this is a consideration of much importance, I have endeavoured, at least in some measure, to supply the deficiency.

According to the tables, it seems that, with a few exceptions, the temperature is considerably higher when the Periodical Summer Birds withdraw, than it is when they appear; and with regard to the Cuckoo and Swift, this is uniformly the case in a remarkable degree: but, as the motions of the Periodical Birds may be supposed to be influenced by the weekly or monthly, rather than by the daily mean temperature, I shall compare the mean temperature of April, the month in which most of the Summer Birds are first seen, with that of September, the month in which they chiefly retire, prefixing the sign + to the difference of the means when the temperature at the time of their departure is in excess, and the sign — when it is in defect.

A comparative view of the mean temperature of April and September, from 1814 to 1828 inclusive.

YEARS.	1814.	1815.	1816.	1817.	1818.
April...	49°.4	45°.2	45°.5	46°.8	45°.1
Sept....	55 .5	54 .4	56 .0	58 .9	58 .3
Difference of means.	+6 .1	+9 .2	+10 .5	+12 .1	+13 .2
YEARS.	1819.	1820.	1821.	1822.	1823.
April...	50°.5	50°.7	48°.5	46°.5	44°.0
Sept....	57 .1	56 .1	58 .4	54 .4	53 .8
Difference of means.	+6 .6	+5 .4	+9 .9	+7 .9	+9 .8
YEARS.	1824.	1825.	1826.	1827.	1828.
April...	45°.6	47°.8	47°.2	47°.4	46°.4
Sept....	57 .0	59 .6	56 .7	56 .2	57 .8
Difference of means.	+11 .4	+11 .8	+9 .5	+8 .8	+11 .4

General mean for April 47°.1, for September 56°.6.—Difference of means +9°.5.

Still the temperature, at the time of the disappearance of the birds under consideration, is found greatly in excess. We will now examine how nearly the mean of October corresponds with that of April.

A comparative view of the mean temperature of April and October, from 1814 to 1828 inclusive.

YEARS.	1814.	1815.	1816.	1817.	1818.
April...	49°.4	45°.2	45°.5	46°.8	45°.1
Oct.....	46 .3	49 .1	50 .6	46 .3	56 .5
Difference of means.	—3 .1	+3 .9	+5 .1	— .5	+11 .4
YEARS.	1819.	1820.	1821.	1822.	1823.
April...	50°.5	50°.7	48°.5	46°.5	44°.0
Oct.....	50 .1	47 .7	50 .5	51 .0	47 .2
Difference of means.	— .4	—3 .0	+2 .0	+4 .5	+3 .2
YEARS.	1824.	1825.	1826.	1827.	1828.
April...	45°.6	47°.8	47°.2	47°.4	46°.4
Oct.....	48 .4	51 .5	52 .4	52 .8	50 .2
Difference of means.	+2 .8	+3 .7	+5 .2	+5 .4	+3 .8

General mean for April 47°.1, for October 50°.0.—Difference of means +2°.9.

A near approximation is observable in the temperature of these months, allowing for the unusual warmth of the latter in 1818; yet the Stonechat, Pied Wagtail, Swallow, House Martin, and Land Rail are almost the only Summer Birds seen in October, and they generally retire before the termination of the third week; though Bats, Dormice, Hedgehogs, and various Coleopterous and Dipterous Insects, &c., are visible till the close of November, and even through the winter when the weather is open. In the year 1820, Long-eared Bats *(Vespertiliones auriti)*, were observed till near the middle of November; and, in 1821, they were first noticed on the 23rd of April, the mean temperature for the day being 50°.5, and were seen through November, to the 8th of December, when the mean temperature was 46°; the mean for November being 47°, which is within 1°.5 of that of April for the same year.

Now, if the Periodical Summer Birds, when they withdraw, do not migrate into more genial climates, they must retire to suitable retreats, in which they pass the winter months in a state of torpidity. But where are such retreats to be found? The notion of the submersion of those birds in lakes, ponds, and rivers, is too absurd to merit a moment's consideration, as they are not only specifically lighter than water, but quite unfitted for existence in it by their organization.

Mr. Gough, in his remarks on migration, published in the *Memoirs of the Literary and Philosophical Society of Manchester*, Vol. II. New Series, from a consideration of the laws which regulate the temperature of the earth at all moderate depths beneath its surface,* clearly establishes the fact, that deep caverns cannot be the winter retreats of the Periodical Summer Birds, as their temperature is not far from the maximum when those birds retire; and is near the minimum about the time that they begin to appear. He then proceeds to observe, (p. 461—2,) that "very few arguments will be now required to demonstrate the impossibility of the analogy which is supposed to connect the Periodical Birds of Summer, and the Sleeping Animals of Winter. It is sufficient barely to remark, that the former are never found slumbering with the latter, near the surface of the earth, and deep caverns are proved to be unfit for the reception of any creature in the torpid season. Consequently the birds in question desert the temperate zones at the approach of winter, to seek a better climate in lower latitudes." These conclusions, however, will appear to have been formed rather hastily, when we consider what numbers of Bats become torpid every winter in this country,

* Those who wish for information on this subject may consult Saussure's *Voyages dans les Alpes*. Tome III, chap. XVIII.

and how rarely they are discovered in their dormitories. Might they not have been derived more satisfactorily, from the circumstance of the Summer Birds being seldom or never found abroad, with the Sleeping Animals, during the mild weather which we frequently have in winter? Bats, Hedgehogs, &c., usually appear when the mean daily temperature is about 50°; but I am not aware that there is a single instance on record, of any of our Periodical Warblers, properly so called, having been observed in the cold season, either in a state of active existence, or of torpidity.* A few, indeed, may occasionally be seen at the customary time in spring, even when the weather is frosty, the increments of temperature by no means corresponding with the sun's increasing northern declination, but they generally seem to withdraw again. On the 9th of April, 1821, several Sand Martins were observed at a sand-pit in the township of Cheetham, but the weather becoming cold and stormy they quickly

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* Since writing the above, I find that Montagu, in the *Supplement to the Ornithological Dictionary,* asserts that he has occasionally discovered the Lesser Pettychaps, *Sylvia Hippolais,* in the south of Devonshire, in mild winters.

disappeared: they were, however, soon after discovered in greatly increased numbers, at a sheltered bend of the river Irwell, in the adjoining township of Broughton. This circumstance proves that, if the weather is severe and boisterous when the Summer Birds are first seen in spring, they do not retire to their winter retreats, as has been supposed, but merely seek sheltered situations, where they can procure a supply of food.

Inquiries into the temperature of the supposed winter retreats of the Periodical Summer Birds, may now be looked upon, it is presumed, as quite superfluous; since it is sufficiently apparent, from the preceding tables, that even that of the atmosphere is much higher at the time those birds disappear than it is when they appear, the very reverse of what ought to be the case if they become torpid, and of what is actually found to be so, with the Sleeping Animals of Winter: indeed, as torpidity does not appear to be induced in any British Animal by a degree of temperature superior to that which is required to revive it from its lethargic state, it is evident that the birds in question must migrate.* As there are, however, several other curious facts relating to the Periodical Birds, which throw great light on the subject of migration, and powerfully tend to confirm this opinion, I shall proceed to examine them.

It is a surprising circumstance, that several species of Periodical Summer Birds almost constantly return to the same places in the same numbers; and there are sufficient reasons for believing that those birds are generally the same individuals. Four or five pairs of Swallows, and about two pairs of Redstarts and of Flycatchers visit our family residence, in Crumpsall, every spring; and White, in his *Natural History of Selborne*, p. 230, says, "among the many singularities attending those amusing birds the Swifts, I am now confirmed in the opinion that we have every year the same number of pairs invariably:" and again, "the number that I constantly find are eight pairs." Now, as those birds usually make their nests in the same situa-

* I have never been able to induce torpidity in the Cuckoo, or in birds of the Swallow tribe, by any experiments which I could devise; though with animals of known torpid habits I have succeeded without difficulty.

tions, this alone is a strong proof of their identity: great additional weight, however, is given to this proof, by the peculiarity of the situations in which such birds occasionally build. For three successive years, a pair of Swallows built in a pig-sty belonging to a relation of mine, their ingress and egress being by a very low entrance; and in Bewick's *History of British Birds*, Vol. I. p. 253, it is stated on the authority of Sir John Trevelyan, Bart., that "at Camerton Hall, near Bath, a pair of Swallows built their nest on the upper part of the frame of an old picture over the chimney, coming through a broken pane in the window of the room. They came three years successively, and, in all probability, would have continued to do so if the room had not been put into repair, which prevented their access to it." White, in speaking of the Selborne Swifts, (*Nat. Hist. Sel.*, p. 186,) says, "they frequent in this village several abject cottages; yet a succession still haunts the same unlikely roofs: a good proof this," he observes, "that the same birds return to the same spots;" and he remarks of the House Martin, (p. 161,) that "the birds that return yearly bear no manner of proportion to the birds that retire;" and this is uniformly the case. Now Swallows and House Martins have frequently two broods in a summer; the first consisting of about five young ones, and the second of three, upon an average; and Redstarts, Fly-catchers, and Swifts, have one brood; the first two species usually rearing four or five, and the last two young ones. What then becomes of this increase? If these young birds do not quit the country, why are they not seen in the ensuing spring? These are perplexing questions, questions which the advocates of torpidity will find it impossible to answer satisfactorily: indeed, they involve difficulties which can only be removed by admitting, what is undoubtedly the case, that these birds migrate; and that, being deserted by the old ones, and losing all recollection of the places where they were brought up, they are directed in their spring flight by fortuitous circumstances, and are thus diffused over a large portion of the globe.

The highly interesting and important fact, that several species of Periodical Summer Birds moult during the interval which elapses between their departure and re-appearance, if generally known to ornithologists, would, it is reasonable to suppose, have been frequently and strenuously urged, as one of the most conclusive arguments which could be advanced in support of migration; but notices of this nature are extremely rare, as perhaps no part of the animal economy of the feathered tribes has been so entirely neglected by natural historians as their moulting. That Swallows, Swifts, Cuckoos, Redstarts and Flycatchers moult during their absence, scarcely admits of a doubt. I have cut feathers out of the wings and tails of Swallows, so that I could easily distinguish them when flying; and I find that such feathers are never replaced while those birds remain with us. Great numbers of young Swallows retire in autumn, before the exterior feathers of their tails have acquired their full length; yet the tail feathers of those birds which return in spring are always perfect in their growth. To these facts I shall add a few extracts from Mr. Pearson's account of his experiments, made for the purpose of preserving Swallows alive through the winter, as given in Bewick's *British Birds*, Vol. 1, p. 250-1, which are decisive as to the moulting of that species.

The first year's experiment failed, but the second attempt was completely successful, as Mr. Pearson states, that "the birds throve extremely well; they sung their song through the winter, and soon after Christmas began to moult, which they got through without any difficulty, and lived three or four years, regularly moulting every year at the usual time. On the renewal of their feathers it appeared that their tails were forked exactly the same as in those birds which return here in the spring, and in every respect their appearance was the same. These birds were exhibited to the Society for promoting Natural History, on the 14th day of February, 1786, at the time they were in a deep moult, during a severe frost, when the snow was on the ground." The account is concluded by Mr. Pearson in the following words. "Jan. 20, 1797.—I have now in my house, No. 21, Great Newport-street, Long Acre, four Swallows in moult, in as perfect health as any birds ever appeared to be in when moulting." The plumage of Swifts, from exposure to the sun and air, loses that deep soot colour which it always has on their arrival, and becomes gradually paler till they withdraw.

This circumstance has not escaped the observation of Mr. White. (See his *Nat. Hist. Sel.* p. 183.) The plumage of young Cuckoos, Redstarts, and Flycatchers, is very different from that of adults. Young Cuckoos have the upper parts marked with various shades of brown, mixed with black, where the old birds are dove-coloured; and the under parts are pale brown, barred with dusky brown, where the old ones are white, barred with black; in short, their appearance is in many respects so totally different from that of their progenitors, that they easily might be, and indeed often have been mistaken for a distinct species. Young Redstarts and Flycatchers have their heads, necks, backs, scapulars, &c., spotted; the former with pale yellow, and the latter with white, which is not the case with old birds; and those marks which so clearly characterize the sexes of Redstarts when their plumage is matured, are altogether wanting in young birds. Now, as young Cuckoos, Redstarts, and Flycatchers, do not usually appear to cast their nest-feathers before they retire, they are readily distinguished from old birds while they stay with us; and as birds of those species are never found to retain their first feathers on their return in spring, they must moult in their absence; and it is probable that this may be the case with the Periodical Summer Birds generally:* but it would be unphilosophical to suppose that those birds, in a state of torpidity, when the animal functions are nearly suspended, can both throw off their old feathers, and put out new ones; therefore, they must seek those countries which supply a requisite degree of warmth, and a sufficient abundance of food, to enable them to change their feathers. It appears from the following passage, extracted from the *Manuel d'Ornithologie* of M. Temminck, second edition, p. 426, that, with regard to the Swallow and House Martin, this distinguished

* In this attempt to prove that some of the Periodical Summer Birds moult during their absence, I have purposely confined my remarks to such species as are well known, and easily observed. The Red-backed Shrike, Whinchat, and some others, with whose habits and economy we are less familiar, might, however, be added to those already enumerated. In my opinion respecting the moulting of the Red-backed Shrike, I am supported by Montagu; who affirms, "that all the young, when they leave us in the month of September, very much resemble the adult female; and the whole return to us again in about six months in their full sexual plumage." See the *Supplement to the Ornithological Dictionary*.

ornithologist had previously arrived at the same conclusion from a consideration of similar facts. "*Je dois* (he remarks) *à M. Natterer de Vienne, l'observation particulièrement intéressante, que les Hirondelles et les Martinets muent une fois l'année en février, par conséquent dans le temps de leur séjour dans les climats chauds de l'Afrique et de l'Asie ; un fait d'ailleurs qui prouve incontestablement contre la prétendue torpeur ou sommeil hivernal de ces oiseaux. Les observations de M. Natterer ont été faites sur des Hirondelles élevées en cage, dont un petit nombre a vécu huit et neuf ans en domesticité.*" Old Cuckoos leave us late in June or early in July, when the temperature is approaching the maximum for the year ; and Swifts retire about the middle of August, when the temperature, though receding from the maximum, is still very high. To what cause, then, shall we attribute the early retreat of those birds ? certainly not to a deficiency of food, as young Cuckoos are frequently found to remain upwards of two months after the old birds have left ; and Swifts are occasionally seen long after the great body of their congeners has withdrawn;* and yet these individuals procure plenty of nourishment. Is it not, rather, occasioned by a disposition to moult, and the want of a suitable degree of warmth to enable them to change their feathers? Our Domestic Fowls begin to moult in July, the hottest month in this latitude, and birds in a state of nature usually moult when they have done breeding: if, therefore, the temperature of July is not sufficiently high to promote the moulting of the Periodical Summer Birds, Cuckoos, as they leave the care of their progeny to strangers, and, of course, are at liberty when they have deposited their

* In the year 1815, I saw a Swift in the township of Crumpsall, on the 20th of October; and the same bird was seen again on the 25th; which is more than two months beyond the time at which this species usually departs, and nearly a fortnight after the last Swallows and House Martins had left us; and in the year 1818, I saw one at Chester, on the 18th, 19th, and 20th of October. I had opportunities of observing both those birds attentively for a length of time, and I remarked that they always seemed to be in the active pursuit of their prey. White, in his *Nat. Hist. Sel.* p. 264, mentions an instance of a Swift being induced, by attachment to its young, to remain till the 27th of August; and though deserted by its mate early in the month, it reared a second brood (the first having been destroyed) without assistance: a convincing proof, that however disagreeable it may be for Swifts to prolong their stay, they are not compelled to quit so early as they do by any difficulty in obtaining food.

eggs, should be the first birds which withdraw. Swifts also, having only two young ones to rear, should be the next birds which retire. The Periodical Warblers, and those birds which have five or six young ones, ought to quit in the next place; and Swallows and House Martins, which have two broods in a season, ought to be the last that depart; and this is always found to be the case; so that whether the departure of these birds be influenced by a disposition to moult, or not, it seems to be regulated, in a great measure, by the cessation of their parental cares, and not by temperature solely.

It will be difficult to produce any direct evidence of the migration of the Periodical Summer Birds, until their winter retreats are well ascertained;* but from what has been already advanced respecting those birds, it will be seen, that this fact may be satisfactorily proved indirectly, by a process of rea-

* Adanson asserts that European Swallows pass the winter in Senegal, but does not particularize the species; (see his *Histoire Naturelle du Sénégal*, p. 67;) and it appears probable, from the observations of Mr. White's brother, (the Rev. J. White,) who resided at Gibraltar, (*Nat. Hist. Sel.* p. 87, 88, 139,) that many of our Periodical Summer Birds may winter in Africa. The length and difficulty of such a journey are

soning somewhat analogous to that adopted by geometricians in investigating such propositions as do not admit of a direct solution; namely, by showing that the contrary supposition involves an absurdity. It is absurd to suppose that the Summer Birds become torpid with an increased or an increasing temperature; or that they can change their feathers in such a state, when the organs of secretion are known barely to perform their several offices; or that, under such circumstances, scarcely more than one fourth of those birds which withdraw in autumn should reappear in spring, though the same birds almost constantly return to the same haunts: these suppositions, I repeat, are manifestly absurd, therefore the Summer Birds must migrate.

Writers, in treating of the Periodical Birds, have confined their observations, almost exclusively, to the various species of Swallow; neglecting, in a great measure, the Short-

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the chief objections which have been urged against this opinion; but they will cease to be looked upon as serious obstacles, when we reflect, that those birds may pass hence to the equator, without crossing any great extent of sea; and that as they are continually advancing into better climates, they are enabled to travel leisurely, there being no necessity for extraordinary haste.

winged Summer Birds, which seem to be the least qualified for migration; and the Periodical Winter Birds, which furnish some of the strongest arguments in support of it.

If the Periodical Winter Birds do not leave this country in spring, they must stay with us the year through; yet it is in the highest degree improbable, that Woodcocks, Jack Snipes, Mountain Finches, and the numerous flocks of Redwings and Fieldfares which are seen in winter, should remain here during the summer months and yet elude the observation of ornithologists. The Redwing is generally admitted to be a Bird of Song;* and as most of the Thrush tribe sing more or less, it is very probable that the Fieldfare is a Singing Bird also; yet we know nothing of their songs, or summer notes, but are merely acquainted with their calls, which are heard in winter only; and I believe there are very few well authenticated instances of the nests of those birds having been found in England.

According to Linnæus, Redwings and

* Linnæus says, that "its lofty and varied notes rival those of the Nightingale." See his *Lachesis Lapponica,* translated by J. E. Smith, M. D. &c. Vol. 1, p. 6.

Fieldfares breed in Sweden. In his *Fauna Suecica* he says of the Fieldfare, that "*maximis in arboribus nidificat;*" and of the Redwing, that "*nidificat in mediis arbusculis, sive sepibus: ova sex cæruleo-viridia maculis nigris variis:*" but it is plain that they must leave that country in winter, as, with us, Redwings are among the first birds which suffer in inclement weather; and both Redwings and Fieldfares withdraw from our northern counties, and great numbers of them even quit the kingdom entirely, during long and severe frosts, especially if they are accompanied with snow.*

Scopoli, in his *Annus Primus*, says of the Woodcock, that "*nupta ad nos venit circa æquinoctium vernale. Nidificat in paludibus alpinis. Ova ponit* 3—5. *Migrat post æquinoctium autumnale. Fugit brumam et acre gelu;*" and of the Fieldfare, that "*migrat Novembri mense.*" Thus it appears that Woodcocks breed in the Tyrol, which they quit about the latter end of September; and

* In the severe winter of 1813-14, the northern counties of England were nearly deserted by Redwings and Fieldfares; and I have been informed, that at this period they were far from being plentiful in the southern counties.

that Fieldfares leave the same country in November. It is well known also, that Woodcocks desert the more northern countries of Europe at the commencement of winter. Here, then, we have positive evidence of the migration of the Redwing, Fieldfare, and Woodcock, some both of their summer and winter haunts being known. That Redwings and Fieldfares migrate, those who are acquainted with their calls may be easily convinced; as the faint scream of the former, and the chattering note of the latter, may be heard frequently repeated through the nights of October and November, as their numerous flights pass over head; and as that is the time at which those birds visit us, and as their calls cease to be heard at night soon after that period, they must then be on their passage from some other country to this, or to countries still farther south. This circumstance also establishes the fact, that some species of Periodical Birds perform their migrations in the night; and it is probable that this is the case with most of them;* as

* M. Temminck, in treating upon the Quail, in the second edition of his *Manuel d' Ornithologie,* makes the following observation, "*voyage le plus souvent au crépuscule ou pendant le clair de lune.*"

I have frequently looked through the woods and plantations in Crumpsall with great care in April, the month in which most of the Summer Birds appear, without perceiving a single individual of any of the migratory tribes; yet early in the morning of the day following that on which the search was made, I have been surprised to hear the notes of the Redstart and Yellow Wren, and to find that the latter species had arrived in considerable numbers. From the undeniable fact, that the males of several Migratory Summer Birds usually precede the females in spring, it would seem that, in these instances, the sexes do not travel in society.

Having endeavoured, in the foregoing remarks, to prove the migration of the Periodical Summer and Winter Birds; I shall here briefly observe, that our Irregular Visitors also must migrate; as it is equally impossible that they should lie torpid during a period of several years, or that they should escape the notice of observers for so great a length of time. Thus, the migration of every description of Periodical Birds, whose disappearance has been difficult to account for, is established according to the sound principles of the inductive logic.

ON THE

NOTES OF BIRDS.

IT is much to be regretted, that the study of ornithology is too frequently confined solely to the perusal of the best authors on the subject, and to the examination and arrangement of preserved specimens, whose faded plumage and distorted forms convey very imperfect ideas of the elegance and symmetry which so eminently distinguish this beautiful and highly interesting part of the creation. To those whom business or inclination leads to reside chiefly in large towns, such are almost the only means of information which offer themselves; but who, that enjoys the opportunity of observing the free denizens of the fields and woods in their native haunts, would exchange their lively and unrestrained activity, their curious domestic economy, their mysterious migrations, and their wild but delightful melody, for the fixed glassy eye and the mute tongue of the inanimate forms which are crowded together in melancholy groups in the museum. Let me not, however, be misunderstood. I do not mean to insinuate, that those collections of birds which enrich the cabinets of the curious are of small utility; on the contrary, I am willing to allow that their importance is very considerable; but I would anxiously guard against an exclusive attention to the collecting and arranging of specimens, to the neglect of what is much more instructive and valuable: I allude to the study of their habits, manners, and economy. In these important particulars the history of birds is still very defective; the majority of authors, foreign as well as native, having limited themselves to the simple enumeration of specific characteristics and distinctions founded principally on structure and colour, and the occasional introduction of a few anecdotes, which from frequent repetition have, in general, lost much of the novelty they once possessed. We must except from this remark, however, the excellent works, in natural history, of our ingenious countryman the late Rev. Gilbert White, of Selborne, in Hampshire, which abound with new and interesting facts. This diligent observer, whose example in investigating nature cannot be too highly recommended, instead of confining himself to the mere classification of natural objects, ranged the extensive wood, the tangled brake, the solitary sheep-walk, and the treacherous morass, to contemplate the manner of life, dispositions, and peculiar characters of their feathered inhabitants in their most sequestered retreats; and his writings bear ample testimony how well his researches were repaid. The subject, however, is still far from being exhausted. Knowledge is acquired slowly; and even the most careful and indefatigable inquirers are liable to errors and omissions. Much yet remains to be supplied, much to be corrected, before the history of British Birds can be pronounced complete.

To the practical ornithologist, who is desirous of promoting and extending his favourite study by the communication of his personal observations and remarks, an intimate acquaintance with the various notes of the feathered tribes is of so much importance, that any difficulties he may encounter in obtaining it, will be more than compensated by the numerous advantages it affords. In many instances it enables him to detect species which might otherwise elude his observation. Thus, the Land Rail, concealed in the long grass of luxuriant meadows, where it runs with great rapidity, and is sprung with difficulty; the Grasshopper Warbler, closely embowered in thick hedges and bushy dingles, where it employs every artifice to escape notice; and the Sedge Warbler, secluded amid the reeds and other aquatic productions of pools and marshes;—are much more frequently heard than seen; the harsh call of the first, the sibilous note of the second, and the hurried song of the last, being repeated through the night, in fine weather, during the breeding season.

It also enables him to identify species with the utmost precision; in some cases, indeed, with much greater certainty than he could by the minutest examination of good specimens. The Wood Wren, Yellow Wren and Lesser Pettychaps, for example, so strongly resemble each other, that even nice observers might have some difficulty in determining them by inspection; and, accordingly, we find that they have been the source of much confusion, perplexity, and error, among writers on ornithology; as their notes, however, are perfectly distinct, a little attention to them is sufficient to remove every difficulty. In the same manner, the Crow may readily be distinguished from the Rook, the Raven from both, and the males of most species from the females.

The arrival of many of the Periodical Warblers is frequently first announced by their songs; and the clamorous night-calls of the Redwing and Fieldfare, in the months of October and November, serve to establish the fact, that those birds migrate, and that they perform their journeys in the dark.

But these are not the only advantages to be derived from an acquaintance with the notes of birds. As the feathered tribes communicate their sensations and intentions to one another through the medium of modulated sounds; the proficient, in what, without any impropriety, may be termed their language, can comprehend their various wants and emotions, and can participate in all their little joys and sorrows, hopes and fears. To him, the music of the groves is not a confusion of pleasing tones merely, but the melodious interchange of thought and feeling; which, though very limited and imperfect, still answers many important purposes, and contributes materially to the happiness and preservation of species. Thus, birds which congregate and which live in society have usually a regular watch stationed in some commanding situation, whose note of alarm is understood by the whole community. Of the truth of this observation, Fieldfares and Rooks furnish familiar and striking instances. The shrill call of the Swallow, the harsh scream of the Jay, the petulant cries of the various species of Titmouse, and the plantive wailing of the Flycatcher, likewise intimate the approach of an enemy. The reiterated cackle of the Domestic Hen after she has laid, speedily announces the joyful event; her cluck indicates that she has become the mother of a family; by a peculiar call she informs her brood whenever she discovers any thing suitable for food; and her shriek is a warning against impending danger. What is usually called the prating of Poultry is expressive of satisfaction and complacency: but it is needless to multiply examples, or to insist further on the many useful purposes to which a familiarity with the language of birds may be rendered subservient. It will suffice to remark, that this knowledge supplies the means of making fresh discoveries; of correcting numerous errors; and of removing many of those doubts and difficulties which have arisen from the great similarity of some species, and the peculiarities incidental to age, sex, and a change of food or climate in others, without placing the observer under the painful necessity of destroying life;—a recommendation which will be duly appreciated by every person possessed of a humane disposition and a reflecting mind.

Having endeavoured in these few preliminary observations to point out the great importance of attending to the notes of birds, I shall now proceed to an inquiry into their origin;—an inquiry well calculated to exercise the skill of the experimentalist, and the ingenuity of the speculative philosopher; though to the generality of mankind it may seem trivial and of little moment.

The only author that I am acquainted with, who has treated this curious subject at any length, is the Honourable Daines Barrington, in an essay entitled *Experiments and Observations on the Singing of Birds*, published in the second part of the sixty-third volume of the *Transactions of the Royal Society*; and as the experiments there detailed appear to be imperfect and unsatisfactory; and the conclusions drawn from them, hasty, unwarranted, and contrary to common experience; and, more especially, as this author is generally referred to by our cyclopædists,* and as his opinions seem to be finding their way into modern works of respectability, where they are quoted as established facts which do not admit of a doubt;† it was thought, that an examination of his method of investigation would be useful in exposing its insufficiency, and the consequent looseness of the arguments founded upon it; while the institution of a less exceptionable course of experiments, it was hoped might dissipate much of the obscurity in which this intricate question is

* See the *Encyclopædia Britannica, Art. Singing;* and Rees' *Cyclopædia, Art. Song.*

† See Bingley's *Animal Biography*, Vol. II. p. 166-167.

at present involved. In what degree these expectations have been realized remains to be shown.

Mr. Barrington informs us, that his experiments were principally made with young Linnets which were fledged, and nearly able to leave the nest; and the reasons assigned for this selection are, that birds of this species are docile, and possess great powers of imitation, and that the cocks are easily distinguished from the hens at an early period. These nestling Linnets were educated under Singing Birds of various kinds; and it appears, that instead of having the Linnet's notes, they learned those of their respective instructors; to which they adhered almost entirely. In some instances, to be sure, the nestlings retained the call of their own species; which, as they were three weeks old when taken from the nest, it is supposed they had learned from their parents; and not unfrequently, when they had opportunities of hearing several species, they borrowed from more than one, and their songs became mixed.*

* The reason given by Mr. Barrington for the steady adherence of birds in a wild state to their own songs, is, that

To be certain that nestlings will not have even the calls of their species, Mr. Barrington remarks, that they should be taken when only a few days old. He then proceeds to notice instances of a Linnet and a Goldfinch taken at this early period, which came under his observation; acknowledging, at the same time, his own inability to rear birds of so tender an age. The first, he states, "belonged to Mr. Matthews, an apothecary, at Kensington, which, from a want of other sounds to imitate, almost articulated the words 'pretty boy,' as well as some other short sentences;" and the owner assured him, that it had neither the note nor call of any bird whatsoever. The Goldfinch had acquired the song of the Wren, without appearing to have a note or even the call of the Goldfinch.

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they attend to the instructions of the parent birds only, disregarding the notes of all others. That young birds receive instructions in singing from the old ones, appears to be a notion of great antiquity. Vide Aristot. *Histor. Animal.* Lib. IV, Cap. IX.—Plinii *Histor. Natural.* Lib. X, Cap. XXIX. The celebrated Count Buffon seems to have entertained a similar opinion. See his *Histoire Naturelle des Oiseaux*. Tome cinquième, p. 47. Darwin also, in *Zoonomia*, Vol I, p. 155, lends it the sanction of his authority.

From these experiments and observations, of which I have given a concise, but I trust impartial account, Mr. Barrington was led to conclude, that "notes in birds are no more innate than language is in man, but depend entirely upon the master under which they are bred, as far as their organs will enable them to imitate the sounds which they have frequent opportunities of hearing." I am not aware, however, that he has brought forward a single fact, from which such an inference can be fairly deduced. The main tendency of his researches is merely to prove (what was before perfectly well known) that some birds have very extraordinary powers of imitation, and may be taught, when young, to sing the notes of other species, whistle tunes, or even pronounce a few words. If his remarks on this subject contain any novelty, it is, that birds so educated sometimes remain satisfied with these imitations, never blending any of their own notes with them; and, indeed, on this solitary circumstance, slight and inconclusive as it is, the entire weight of his argument is rested. The instances of the Goldfinch acquiring the song of the Wren, and Mr. Matthews' Linnet learning to articulate one or two short sentences, without having even the calls of their species, which this author seems to think so decisive, prove no more than his own experiments; which, as they were made, for the most part, with birds remarkable for their imitative powers, were certainly by no means well adapted to his purpose. As for the Goldfinch, Mr. Barrington heard it only once, and then but for a short time; and that no dependance could be placed on any report of the people to whom it belonged, is evident from their supposing that it sang its own notes. These are circumstances which powerfully tend to invalidate almost every thing of importance that has been advanced respecting this bird.

In order to ascertain whether nestlings when taken very young will or will not have the calls and songs of their species, they should be kept in situations where they have no opportunity of learning any sounds which they may substitute for them; but this, I believe, has never yet been attempted.

I have already asserted, that Mr. Barrington's conclusions are contrary to common experience. I shall now endeavour to establish this charge.

It is well known to most persons who have the care and management of Poultry, that Ducks, Guinea Fowls, &c., hatched under the Domestic Hen, and Domestic Fowls hatched under Turkeys, have the calls and habits peculiar to their species. That this is the case also with Pheasants and Partridges, brought up under similar circumstances, I have had frequent opportunities of observing. It is a matter of universal notoriety likewise, that all Cuckoos of the species *canorus*, though hatched and reared by birds of various descriptions, have constantly their proper calls.*

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* Mr. Barrington will not allow that the well known cry of the Cuckoo is a song, because it does not happen to accord with the conditions of his arbitrary definition; though, to the bird, it answers every purpose of a song, as well as the more elaborate effusions of the Nightingale and Skylark. Mr. Barrington defines a bird's song to be a succession of three or more different notes, which are continued without interruption, during the same interval with a musical bar of four crotchets in an adagio movement, or whilst a pendulum swings four seconds; which necessarily excludes the Chaffinch, Redstart, Hedge Warbler, Yellow Wren, and some others, which have always been accounted birds of song, as well as the Cuckoo, from any pretensions to the title. Perhaps it would be more natural, and certainly less exclusive, to apply the term song to those notes which are peculiar to the males; yet this definition would admit the Peacock and Turkey into the catalogue of Singing Birds, and the hideous scream of the one, and the ludicrous gobble of the other, are certainly any thing but musical.

These facts, one would suppose, were quite sufficient to convince the most prejudiced, that birds do not always acquire the calls and notes of those under which they are bred. But, perhaps, it may be urged, that Ducks, Guinea Fowls, Pheasants, and Partridges, are probably incapable of learning the calls of Domestic Fowls; that Domestic Fowls, in their turn, may be incapable of acquiring the call of the Turkey; and that the Cuckoo appears to be very poorly qualified for imitating the notes of its foster parents. Still I must contend, that the incapacity of those birds has never been proved; and even if it had, it would afford no explanation of the manner in which they become acquainted with their own respective calls. According to Mr. Barrington's theory they ought to be mute; or, at least, should have such notes only as they have been able to pick up casually; which, of course, would possess little or no resemblance.

From these, and similar observations, I have long been thoroughly convinced myself, that the calls of birds, which seem to be the simplest expressions of their sensations, are natural, not acquired; and in order to determine whether this is the case with their songs also, which are generally much more complex, and, consequently, have the appearance of being more artificial, the following experiments were made.

In the summer of 1822, I procured three young Greenfinches,—a cock and two hens; which, as they did not see till the fourth day after they were taken from the nest, must then have been only two days old.*

These birds were reared by hand, in a house situated in the town of Manchester; where they had no opportunity of hearing the notes of any bird, except, perhaps, the occasional chirping of Sparrows: nevertheless, they had all their appropriate calls, and the cock bird had the song peculiar to its species.

It was hoped, at the time, that this experiment would be considered sufficiently decisive; but recollecting that some persons, for the sake of showing their ingenuity in raising objections, might say that these birds remembered the notes of their parents, which they imitated as soon as they had acquired

* From numerous observations which I have made, it appears that young birds usually begin to see about the sixth day after they are hatched.

the power; and being willing to remove every circumstance on which the most fastidious inquirer could fix a doubt, I placed the eggs of a Redbreast in the nest of a Chaffinch, and removed the eggs of the Chaffinch to that of the Redbreast; conceiving, that if I was fortunate in rearing the young, I should, by this exchange, insure an unexceptionable experiment, the result of which must be deemed perfectly conclusive by all parties. In process of time these eggs were hatched, and I had the satisfaction to find that the young birds had their appropriate chirps.*

When ten days old they were taken from their nests, and were brought up by hand, immediately under my own inspection; especial care being taken to remove them to a distance from whatever was likely to influence their notes. At this period, an unfortunate circumstance, which it is needless to relate, destroyed all these birds, except two,—a fine cock Redbreast, and a hen Chaffinch; which, at the expiration of twenty-one days from the time they were hatched, commenced the

* Mr. Barrington defines the chirp to be the first sound a young bird utters as a cry for food. It consists of a single note, repeated at short intervals, and is common to nestlings of both sexes.

calls peculiar to their species. This was an important point gained, as it evidently proved that the calls of birds, at least, are instinctive; and that, at this early age, ten days are not sufficient to enable nestlings to acquire even the calls of those under which they are bred; thus, clearly establishing the validity of the first experiment made with the young Greenfinches. Shortly after, the Redbreast began to record;* but in so low a tone, that it was scarcely possible to trace the rudiments of its future song in those early attempts. As it gained strength and confidence, however, its native notes became very apparent; and they continued to improve in tone, till the termination of July, when it commenced moulting; which did not, as was expected, put a stop to its recording.† About the middle of August it was in deep moult, and by the beginning of October had acquired most

* The first endeavours of a young bird to sing are termed recording.

† The important operation of moulting undoubtedly affects the singing of wild birds very considerably; and may, perhaps, be a principal cause of their silence in the month of August. The London birdcatchers are well aware of the advantages of occasioning their call-birds to moult prematurely, which, by this means, are brought into full song, while other birds are nearly mute. For an account of the manner in which this is effected, see Pennant's *British Zoology*, Vol. II, p. 332.

of its new feathers. It now began to execute its song in a manner calculated to remove every doubt as to its being that of the Redbreast, had any such previously existed:* its habits also were as decidedly characteristic as its notes, and I am the more particular in noticing this latter circumstance, because the peculiar habits of birds are quite as difficult to account for as the origin of their songs.† Thus, it appears from this satisfactory experiment, which was conducted with the utmost care, that, contrary to Mr. Barrington's opinion, the notes of birds, which probably consist of those sounds that their

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* Montagu, in the *Introduction to the Ornithological Dictionary*, p. 29, states, in a note, that "a Goldfinch, hatched and fostered by a Chaffinch, retained its native notes," but does not give any further particulars respecting this bird.

† Several birds sing in the night, and some warble as they fly. The Titlark uses particular notes in ascending and descending, and the song of the White-throat is accompanied with strange gesticulations. Larks and Wagtails run; Finches and Buntings hop; nearly the whole of the Gallinaceous and Pie-tribes, and many species of Waterfowl walk; and Woodpeckers climb. The Sparrow, Skylark, and most of the Gallinæ are pulveratrices; and the Kestril, when it hovers, may be distinguished from every other British Falcon by the fanning motion of its wings. Peculiarities in the modes of flight and nidification of various species are equally remarkable and worthy of notice; but, as they are foreign to the present subject, I shall not now dilate upon them.

vocal organs are best adapted to produce, are perfectly instinctive.*

Having shown that the notes of birds are natural, or, in other words, that they do not depend upon any previous instruction, it follows, that they must furnish the attentive ornithologist with an excellent method of distinguishing species, under all the various circumstances which are liable to affect their plumage; though it must be observed, that the great similarity, so evident in the songs of birds of the same species, is more in tone and style, than in the individual notes of which they are composed.†

I shall here remark, that it is highly probable that no bird, in a wild state, ever borrows the notes of others, or becomes a mocker.

* Since writing the above, I have met with the following general assertion, in the *Physiognomical System of Drs. Gall and Spurzheim;* by J. G. Spurzheim, M. D. Second edition, p. 194—5. "Singing birds, moreover, which have been hatched by strange females, sing naturally, and without any instruction, the song of their species as soon as their internal organization is active. Hence the males of every species preserve their natural song, though they have been brought up in the society of individuals of a different kind." This inference, I have been recently assured by Dr. Spurzheim, was deduced from carefully conducted experiments made by Dr. Gall.

† Birds of the same species do not always deliver their notes exactly in the same order of succession; neither do they uniformly use precisely the same notes.

I am well aware, that several of our native birds, as the Pettychaps and Sedge Warbler, have usually been termed Mocking Birds; but this is certainly improper; as they constantly use their own natural notes, and no others, they do not at all merit this appellation. The fine strain of the first has been thought to bear a striking resemblance to those of the Swallow and Blackbird. This, however, must be entirely imaginary, as it is totally different from them in manner and notes. If it be possible to trace any similarity between them, it will be found to consist in tone merely. The song of the Sedge Warbler is wonderfully varied, and appears to be chiefly composed of passages borrowed from the songs of the Skylark, Titlark, Whitethroat, Whinchat, Lesser Redpole, Swallow, &c. Now if any bird is entitled to the epithet of mocker, surely it is this; yet these resemblances are common to the songs of the whole species, which inhabits situations very unsuitable for acquiring some of them. In short, these fancied imitations are not studied, but purely accidental, consisting of their own notes *ab origine.*

The singing of birds has been very generally attributed to the passion of love, and a desire of pleasing their mates.

> "'Tis love creates their melody, and all
> This waste of music is the voice of love;
> That even to birds, and beasts the tender arts
> Of pleasing teaches."*

Thus the great poet of nature elegantly expresses the idea. This opinion, however, does not appear to be well founded; their language of love, their amorous strains, consist of low, intermitted tones, accompanied with ridiculous gesticulations; and are altogether different from their ordinary songs, which seem to be occasioned by an exuberance of animal spirits, arising from an abundance of nourishing food, and an increase of temperature, and by a spirit of emulation and rivalry among the males. In confirmation of what is here advanced, I shall observe, that I have known many instances of birds having nests after they have entirely ceased singing; and that some species, as the Woodlark, Redbreast, and Wren, sing long after they have done breeding. Caged birds also continue in song much longer than birds at large, though they have no mates to solace and amuse; and it is remarkable, that almost

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* Thomson's *Seasons, Spring.*

any kind of continued noise is sufficient to stimulate them to sing. That birds of the same species distinguish each other by their notes, better than by any other circumstance, and that the songs of the males serve to direct the females where to seek their society, as Montagu has suggested, appears to me highly probable; but I must differ from this ingenious naturalist, when he asserts, that love is the sole cause of their songs.* In support of this opinion he states, that the males of our Warblers, before they pair in spring, sing almost incessantly, and with great vehemence; that from the time of pairing till the hens begin to sit, they are neither so vociferous, nor so frequently heard as before; that during the time of incubation their songs are again loud, but not so reiterated as at the first; and that so soon as the young are excluded from the eggs, they cease singing entirely:† but it may be remarked, that if they are not heard so frequently and earnestly after pairing as before, most probably it is because they are occupied in attending to

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* This he does, in effect, in the *Introduction to the Ornithological Dictionary*, p. 28, and following.

† See the *Introduction to the Ornithological Dictionary*, p. 30, 31.

the females; and I have already observed, that their amatory notes, which they chiefly use at this period, are totally different from their ordinary songs. When the hens are sitting, or by any accident happen to be separated from their mates, the attention of the latter is much less engrossed; their notes of love are suspended, and their customary strains renewed. It is a very mistaken notion of Montagu, that the songs of these birds cease immediately when their eggs are hatched; as, in numerous instances, it is notorious that they continue even for some time after the young have left the nest. Surely it is needless to insist, that it cannot be love which prompts the young males to attempt their songs so soon as they are known to do:* besides, it has been shown, that when educated early under other species, they sometimes possess their notes exclusively; which would hardly be the case, if love is their only motive for singing.

For the information of those who may wish to be acquainted with the Singing Birds of this particular neighbourhood, I subjoin the following catalogue.

* Young birds frequently begin to practise their songs when only a month old.

A Catalogue of Singing Birds heard in the neighbourhood of Manchester; with the periods at which they commence and discontinue their Songs, taken at a mean of eleven years' observations, commencing with 1818 *and terminating with* 1828.

BIRDS.	Commence Singing.	Cease Singing.
Redbreast—Sylvia Rubecula	Jan. 2.	Dec. 30.
Wren—Sylvia Troglodytes*	„ 3.	„ 25.
Missel Thrush—Turdus viscivorus†	„ 24.	June 5.
Throstle—Turdus musicus	„ 27.	Aug. 8.
Hedge Warbler—Accentor modularis	Feb. 1.	July 21.
Skylark—Alauda arvensis	„ 5.	„ 16.
Chaffinch—Fringilla cœlebs	„ 11.	„ 8.
Starling—Sturnus vulgaris	„ 16.	June 6.
Blackbird—Turdus Merula	March 5.	July 19.
Titlark—Anthus pratensis	„ 19.	„ 18.
Woodlark—Alauda arborea	„ 20.	Oct. 23.
Greenfinch—Fringilla Chloris	„ 26.	Aug. 17.
Wheat-ear—Saxicola Œnanthe	April 9.	June 19.
Linnet—Fringilla cannabina	„ 11.	July 12.
Yellow Wren—Sylvia Trochilus	„ 12.	Aug. 20.
Redstart—Sylvia Phœnicurus	„ 13.	July 17.
Lesser Fieldlark—Anthus arboreus	„ 14.	„ 9.
Lesser Redpole—Fringilla Linaria	„ 15.	„ 22.
Goldfinch—Fringilla Carduelis	„ 15.	„ 3.
Whinchat—Saxicola Rubetra	„ 26.	„ 9.
Swallow—Hirundo rustica	„ 26.	Sept. 21.
Black-cap—Sylvia Atricapilla	„ 28.	July 17.
White-throat—Sylvia cinerea	„ 29.	„ 20.
Stonechat—Saxicola Rubicola	„ 30.	„ 3.
Lesser White-throat—Sylvia Curruca	May 1.	„ 12.
Sedge Warbler—Sylvia Phragmitis‡	„ 3.	„ 23.
Pettychaps—Sylvia hortensis	„ 6.	„ 14.
Red-backed Shrike—Lanius Collurio	„ 20.	„ 17.

* The Redbreast and Wren sing at all times of the year, except during severe frost; and several species of birds which cease singing about the latter end of July, or the beginning of August, are sometimes heard again in autumn; when their songs are generally feeble, imperfect, and of short continuance, like the early efforts of our Warblers in spring.

† The Missel Thrush is the largest British bird of song.

‡ In this catalogue I have omitted the Yellow Bunting, Reed Bunting, Golden-crested Wren, Wood Wren, and some others, which have not uniformly been accounted Singing Birds.

It would be difficult, nay impossible, to convey a distinct idea of the songs of these birds by any verbal description; indeed, the delightful associations they excite, with the adventitious circumstances of time, distance, situation, &c., so greatly influence their effect, that even the best imitations are utterly inadequate to produce any thing equal to it.

Mr. Barrington, in his essay, has attempted to construct a table, by which the comparative merits of British Singing Birds may be examined; but as he does not appear to have formed a correct estimate of the songs of some species, and as his table is inaccurate in other respects, besides being too limited, I have endeavoured to supply one which will be more comprehensive, and, I trust, less objectionable; making, as he has done, the number 20 the point of absolute perfection.

BIRDS.	Mellowness.	Sprightliness.	Plaintiveness.	Compass.	Execution.
Nightingale—Sylvia Luscinia	19	14	19	19	19
Redbreast—Sylvia Rubecula	13	8	14	16	17
Skylark—Alauda arvensis..............	4	19	4	17	15
Black-cap—Sylvia Atricapilla..........	14	12	12	10	8
Pettychaps—Sylvia hortensis	14	6	14	10	9
Woodlark—Alauda arborea	18	2	17	8	6
Linnet—Fringilla cannabina	10	13	9	9	11
Sedge Warbler—Sylvia Phragmitis*	2	16	2	18	10
Goldfinch—Fringilla Carduelis	4	14	4	9	11
Throstle—Turdus musicus	3	12	2	10	5
Blackbird—Turdus Merula	8	2	7	5	5
Lesser Fieldlark—Anthus arboreus	8	5	6	4	4
Yellow Wren—Sylvia Trochilus	6	5	6	4	4
Chaffinch—Fringilla cœlebs	2	16	1	4	4
Wren—Sylvia Troglodytes	1	19	0	4	4
Pied Flycatcher—Muscicapa luctuosa ..	5	5	5	4	4
Greenfinch—Fringilla Chloris	5	3	4	4	3
Dipper—Cinclus aquaticus	4	5	3	4	3
Hedge Warbler—Accentor modularis....	3	4	3	4	4
Missel Thrush—Turdus viscivorus	3	4	2	5	3
Swallow—Hirundo rustica	3	6	2	3	3
Red-backed Shrike—Lanius Collurio....	2	4	2	4	2
Starling—Sturnus vulgaris	4	2	2	4	2
Titlark—Anthus pratensis	2	3	2	2	2
Shorelark—Anthus aquaticus	2	2	2	2	2
White-throat—Sylvia cinerea	1	4	0	4	3
Redstart—Sylvia Phœnicurus	1	4	0	3	3
Whinchat—Saxicola Rubetra	1	3	1	3	2
Siskin—Fringilla Spinus	1	4	0	3	2
Lesser Redpole—Fringilla Linaria	1	4	0	3	2
Wheat-ear—Saxicola Œnanthe	1	3	0	3	2
Stonechat—Saxicola Rubicola..........	1	3	0	2	2
Lesser White-throat—Sylvia Curruca ...	1	2	0	2	2
Dartford Warbler—Sylvia provincialis†. .					
Reed Wren—Sylvia arundinacea........					

* Mr. Barrington has inserted the Chaffinch, Hedge Warbler, and Reed Sparrow, in his table; which (according to his definition of a bird's song) ought not to have been admitted: indeed, the notes of the Reed Sparrow are so mean, that I am inclined to believe that he has attributed the song of the Sedge Warbler to this species, especially, as he remarks, in a note, that it sings in the night; an error by no means uncommon among ornithologists;—yet, if this is the case, he has greatly underrated it; for though harsh in tone, and hurried in manner, and though the same note is repeated frequently in succession, it certainly possesses great variety, and is, upon the whole, rather agreeable.

† I have included the Dartford Warbler, and the Reed Wren, on the authority of Montagu, (see the *Ornithological Dictionary and Supplement*,) but I possess no means of estimating the songs of these species, having never heard them.

This long catalogue of birds, most of which, it appears, are to be found in this immediate neighbourhood, composes the feathered choir, which enlivens the pastoral scenery of England with a rich and varied melody of song which probably is not surpassed in any part of the known globe.

The following poetical description of the vernal chorus, with which I shall close these observations, is from Thomson's *Seasons, Spring*.

"Up springs the lark,
Shrill voic'd, and loud, the messenger of morn;
Ere yet the shadows fly, he mounted sings
Amid the dawning clouds, and from their haunts
Calls up the tuneful nations. Every copse
Deep-tangled, tree irregular, and bush
Bending with dewy moisture, o'er the heads
Of the coy quiristers that lodge within,
Are prodigal of harmony. The thrush
And wood-lark, o'er the kind contending throng
Superior heard, run through the sweetest length
Of notes; when listening Philomela deigns
To let them joy, and purposes in thought
Elate, to make her night excel their day.
The blackbird whistles from the thorny brake;
The mellow bullfinch answers from the grove:
Nor are the linnets, o'er the flowering furze
Pour'd out profusely, silent. Join'd to these,
Innumerous songsters, in the freshening shade
Of new-sprung leaves, their modulations mix
Mellifluous. The jay, the rook, the daw,
And each harsh pipe, discordant heard alone,
Aid the full concert; while the stock-dove breathes
A melancholy murmur thro' the whole."

OBSERVATIONS ON

THE CUCKOO.

DURING a period of more than two thousand years, from the time of Aristotle, the father of Natural History, to the year 1788, when the excellent observations of Mr., afterwards Dr. Jenner, so justly celebrated for the introduction of vaccination, were published in the *Transactions of the Royal Society*,* the history of the Cuckoo, if it deserved the appellation, consisted of a tissue of extravagant fables, very sparingly interspersed with facts. It will not be necessary to particularize the many fanciful conjectures transmitted to us by the ancients respecting this bird, as they have been repeatedly noticed by authors of eminence, and are suffi-

* Vol. LXXVIII. Pt. 2.

ciently well known to the classical ornithologist. It may be observed, however, that so profound has been the veneration of succeeding ages for the opinions of antiquity, and so unbounded the confidence in the accuracy of those collected by Aristotle on this particular subject, that, notwithstanding the great absurdity of some of them, they long continued to maintain the reputation they had acquired, a few slight additions and corrections only having been made by more modern writers, till the publication of Dr. Jenner's interesting discoveries: indeed, almost the only facts in the obscure history of this singular species, which seem to have been known with any tolerable degree of certainty, even towards the close of the eighteenth century, were, that Cuckoos appear and disappear periodically; that the call from which they take their name is peculiar to the male; that the female lays in the nests of other birds; that those birds carefully bring up the young Cuckoo, which has a weak, plaintive chirp, and is very different in plumage from the old ones; and that it is generally observed to be the sole occupier of the nest. In this state the history of the Cuckoo remained, when

Dr. Jenner, at the request of Mr. John Hunter, undertook to investigate the habits and economy of that extraordinary bird; and in the course of his researches, which were conducted with great care and assiduity, he discovered a number of curious facts, scarcely less wonderful than the marvellous but visionary speculations of the ancients themselves. The following brief abstract will serve to convey some idea of what his skill and industry effected.

Dr. Jenner informs us, that the first appearance of Cuckoos in Gloucestershire, where his observations were made, is about the 17th of April. The song of the male, which is well known, soon proclaims his arrival: that of the female (if the peculiar notes of which it is composed may be so called) is widely different, and has been so little attended to, that few are acquainted with it; it is thought, however, to bear some resemblance to the cry of the Little Grebe.

Unlike the generality of birds, Cuckoos do not pair; and as their eggs are seldom met with till about the middle of May, it is supposed that the females do not begin to lay till some weeks after their arrival. Cuckoos deposit their eggs in the nests of a great variety of small birds, intrusting them to the care of the Hedge Warbler, Pied Wagtail, Titlark, Yellow Bunting, Greenfinch, Whinchat, &c. Among these, they usually select the three first, but show a much greater partiality to the Hedge Warbler than to any of the rest. The Hedge Warbler commonly takes up four or five days in laying her eggs, and during this time (generally after she has laid one or two) the Cuckoo contrives to deposit hers among the rest. This intrusion often occasions some discomposure; for the Hedge Warbler, at intervals, whilst she is sitting, not unfrequently throws out some of her own eggs; and sometimes injures them in such a way that they become addle; however, she is rarely observed to throw out or injure that of the Cuckoo. She continues to sit the same length of time as if no foreign egg had been introduced, the Cuckoo's requiring no longer incubation than her own; nay, it frequently happens that it is hatched first. The Titlark is often selected by the Cuckoo to take charge of its offspring, but, as it is a bird less familiar than many which have been mentioned, its nest is not so often discovered.

The young Cuckoo, soon after it is excluded from the egg, commences the extraordinary practice of turning out its companions, which are usually left to destruction. The mode of accomplishing this is very curious: with the assistance of its rump and wings, it contrives to get a young bird upon its back, and making a lodgment for the burden by elevating its pinions, clambers backward with it up the side of the nest, till it reaches the top, where, resting for a moment, it throws off its load with a jerk, and quite disengages it from the nest. It remains in this situation a short time, feeling about with the extremities of its wings, as if to be convinced that the business is properly executed, and then drops into the nest again. It frequently examines, as it were, an egg or nestling with the ends of its wings, before it begins its operations; and the nice sensibility which these parts appear to possess, seems sufficiently to compensate for the want of sight, of which sense it is at first destitute. It is wonderful to see the extraordinary exertions of the young Cuckoo, when it is two or three days old, if a bird be put into the nest which is too weighty for it to lift out. In this state, it seems ever restless and uneasy, but the disposition for turning out its companions continues to decline, from the time it is two or three, till it is about twelve days old, when it usually ceases: indeed, the disposition for throwing out the egg appears to cease a few days sooner; for the young Cuckoo, after it has been hatched nine or ten days, will frequently remove a nestling which has been placed in the nest with it, when it will suffer an egg, put there at the same time, to remain unmolested. The singularity of its shape is well adapted to these purposes; for, different from other newly hatched birds, its back, from the scapulæ downwards, is very broad, with a considerable depression in the middle, which seems formed by nature for the design of giving a more secure lodgment to any object that the young Cuckoo may be desirous of removing from the nest. When it is about twelve days old, this cavity is quite filled up, and then the back assumes the shape common to nestling birds in general. The same instinctive impulse which directs the Cuckoo to deposit her eggs in the nests of other birds, directs her offspring to throw out the eggs and young of the owners of the nests. The scheme of nature would be incomplete without it; for it would be extremely difficult, if not impossible, for the small birds, destined to find support for a young Cuckoo, to find it for their own young ones also, after a certain period; nor would there be room for the whole to inhabit the nest.

The eggs of the Cuckoo are remarkably small in proportion to the size of the bird; they also vary considerably in size, weight, and colour. It sometimes happens that two are deposited inthe same nest; and Cuckoos' eggs are frequently hatched in the nests of other birds, after the birds which laid them have disappeared.

There is certainly, Dr. Jenner observes, no reason to be assigned from the formation of the Cuckoo, why, in common with other birds, it should not perform the several offices of nidification, of incubation, and of rearing its young. It is, in every respect, perfectly formed for collecting materials and constructing a nest; neither its external shape nor internal structure prevent it from hatching its eggs; nor is it, by any means, incapacitated for bringing food to its young. To what cause then, he inquires, must we attribute the singularities of this bird? May they not be owing to the following circumstances? The short residence it is allowed to make in the country where it is destined to propagate its species, and the call which nature has upon it, during that short residence, to produce a numerous progeny. The Cuckoo's first appearance in Gloucestershire is about the middle of April, commonly on the 17th; its egg is not ready for incubation till some weeks after its arrival, seldom before the middle of May; a fortnight is taken up by the sitting bird in hatching the egg; the young bird generally continues three weeks in the nest before it flies; and the foster parents feed it more than five weeks after that period; so that, if a Cuckoo should be ready with an egg much sooner than the time pointed out, not a single nestling, even of the earliest, would be fit to provide for itself, before its parent would be instinctively directed to seek a new residence, and would be thus compelled to abandon its young one; for old Cuckoos take their final leave of this country in the first week of July.

If nature had allowed the Cuckoo to stay here as long as some other Migratory Birds, which produce a single set of young ones, as the Swift or Nightingale for example, and had allowed it to rear as large a number as any bird is capable of bringing up at one time, these might not have been sufficient to answer her purpose; but by sending the Cuckoo from one nest to another, it is reduced to the same state as the bird whose nest is daily robbed of an egg, in which case the stimulus for incubation is suspended. Of this we have a familiar example in the common Domestic Fowl. That the Cuckoo actually lays a great number of eggs, dissection seems to prove very decisively. Upon comparing the ovarium, or racemus vitellorum, of a female Cuckoo, killed just as she had begun to lay, with that of a pullet, killed just in the same state, no essential difference appeared: the uterus of each contained an egg perfectly formed, and ready for exclusion; and the ovarium exhibited a large cluster of eggs gradually advanced from a very diminutive size, to the greatest the yolk acquires before it is received into the oviduct. The appearance of one killed on the third of July was very different. In this a great number of the membranes which had discharged yolks into the oviduct might be distinctly traced, and one of them appeared as if it had parted with a yolk on the preceding day. The ovarium still exhibited a cluster of enlarged eggs, but the most forward of them was scarcely larger than a mustard seed.

It plainly appears, Dr. Jenner remarks, that birds can keep back or bring forward their eggs (under certain limitations) at any time during the season appointed for them to lay; but the Cuckoo, not being subject to the common interruptions, goes on laying from the time she begins, till the eve of her departure from this country; for, although old Cuckoos generally take their leave in the first week of July, yet instances are not wanting of eggs having been hatched so late as the middle of that month.

Among the many peculiarities of the young Cuckoo, there is one which shows itself very early. Long before it leaves the nest, it frequently, when irritated, assumes the manner of a bird of prey, looks ferocious, throws itself back, and pecks at anything presented to it with great vehemence; often, at the same time, making a chuckling noise, like a young Hawk. Sometimes, when disturbed in a smaller degree, it makes a kind of hissing noise, accompanied with a heaving motion of the whole body.

Its chirp is plaintive, like that of the Hedge Warbler, but the sound is not acquired from the foster parent, as it is the same whether it be reared by the Hedge Warbler, or by any other bird. It never acquires the adult note during its stay in this country.

The growth of the young Cuckoo is very rapid, and as it is fed for a long period by the small birds which have the care of it, they frequently have to perch on its back, or half expanded wing, in order to gain a sufficient elevation to put the food into its mouth.

There seems to be no precise time fixed for the departure of young Cuckoos. Probably they go off in succession, as soon as they are capable of taking care of themselves; for though they stay here till they become nearly equal in size, and growth of plumage, to old ones, yet in this very state, the care of their foster parents is not withdrawn from them. If they did not go off in succession, it is probable that we should see them in large numbers by the middle of August; for as they are to be found in great plenty, when in a nestling state, they must then appear very numerous, since all of them must have quitted the nest before that time; but this is not the case, for they are not more numerous at any season, than the parent birds are in the months of May and June.

Such are the most important particulars which have resulted from Dr. Jenner's well conducted inquiry, and to the accuracy of the greater part of them I can unite my testimony with that of others, though, in a few instances, our opinions do not entirely coincide.

Dr. Jenner states, that Cuckoos continue to lay regularly from the exclusion of the first egg to the time of their departure, and supposes that they are enabled to do so by intrusting the care of their progeny to strangers; being placed by this circumstance, he observes, in a similar situation to the bird whose nest is daily robbed of an egg. Now if Dr. Jenner means to assert (and this, I think, is the only rational explanation which his language admits) that birds, during the breeding season, can produce eggs at will, and that they may be excited to lay in succession many more than their usual number, by daily removing one from their nests, he is certainly mistaken: Colonel Montagu's experiments,* as well as my own, decidedly prove the contrary, both with regard to wild and domestic birds.

As Cuckoos deposit a single egg only in the same nest, they have been thought, by most persons, to lay no more than one. Dr. Jenner, on the contrary, supposes, from an examination of the ovary in a bird which had just commenced laying, and from having observed that Cuckoos' eggs are occasionally laid about the time that the old birds disappear, that they produce a large number. With due deference to such high authority as Dr. Jenner, I think there are sufficient reasons for believing, that both these extremes are erroneous. According to Montagu,† whose opinion is founded on the dissection of breeding females, Cuckoos lay from four to six eggs; and this is probably near the truth. In females opened when they had just begun to lay, only four or five eggs were usually discovered, that could possibly be laid in succession; from the smallest of

* *Ornithological Dictionary, Introduction,* p. 10, and following.

† *Ornithological Dictionary, Introduction,* p. 8, and following.

which, to what may be termed the secondary eggs, there was a sudden break off,—not a gradual decrease in size. The scarcity also of the eggs and young of this species, even in its favourite haunts, tends powerfully to confirm the opinion, that Dr. Jenner has greatly overrated its fecundity.*

It is possible, that those Cuckoos which arrive early may sometimes lay two sets of eggs during their stay with us; but then we may safely conclude, that a considerable interval of time always elapses between the production of the first and second sets; and it is quite as probable, that those eggs which are occasionally found in July should be laid by birds which arrive late, as by early coming birds which produce more than one set of eggs; for Cuckoos come and go in succession, some individuals appearing three weeks, or even a month before others: besides, it may frequently happen, that many females have not an opportunity of forming a connexion

* White Moss, a bog of considerable extent, situated about four miles to the N. E. of Manchester, is a very favourite resort of Cuckoos; yet the turf cutters inform me, that even in the most favourable seasons they never knew of more than five or six eggs belonging to this species in different nests at the same time.

with the other sex till long after their arrival; for though it is generally asserted that Cuckoos do not pair, and hence it may be inferred that the intercourse between the sexes must be greatly facilitated, yet the accurate observations of my friend R. G. Baker, Esq., certainly render this opinion doubtful. In the spring of 1823, he noticed that a pair of Cuckoos frequented the same spot for more than a fortnight, and were so jealous of the approach of any other bird of the same species, that they constantly united their efforts to drive away an intruder, and always with success. I may add, that the male was distinguished from every other in the vicinity by the deepness of his note. This unquestionably looks like pairing, and should, at least, prevent a hasty decision on a point which deserves further investigation.

Colonel Montagu, from the extraordinary fact related by Dr. Jenner, of two Hedge Warbler's eggs, containing living fœtuses, having been found under a young Cuckoo about a fortnight old, and from the difficulty which he supposes Cuckoos would have in meeting with nests in a suitable state to receive their eggs, if they were compelled to lay them in regular succession, conjectures, that contrary to the generality of birds, they have the power of retaining the egg in the uterus after it is perfected, and that while it remains there, the embryo is progressively advanced towards maturity by the internal heat of the parent's body.* Now, without having observed a single circumstance in the whole course of my inquiries which at all tends to corroborate this opinion of Montagu's, I have discovered a curious fact, which appears to render such a supposition altogether unnecessary. On the 5th of May, 1822, I saw a Cuckoo in the act of watching a pair of Titlarks construct their nest. The Larks had just commenced building, and did not seem to be at all disconcerted at the presence of the Cuckoo, which sat on the ground, about seven or eight yards from the spot, attentively observing them; and, when disturbed, flew away with great reluctance, and only to a short distance. This nest, which was on Kersal Moor, where the races are annually held, was too distant from my residence to permit me to examine it frequently, and to make such numerous and minute

* *Ornithological Dictionary, Introduction,* p. 15.

observations as I wished; but on the 12th of May I again visited it, in the confident expectation that it would contain a Cuckoo's egg, and I was not disappointed. I may further remark, in confirmation of this discovery, which, by exhibiting a curious, and hitherto unnoticed, instinctive propensity of this bird, forms an interesting addition to its history, that Cuckoos almost invariably deposit their eggs in the nests of other birds, as soon as those birds begin to lay; not unfrequently, indeed, immediately after the exclusion of the first egg; and Mr. Baker informs me, that he saw the hen of that pair of Cuckoos, which he observed so closely last spring, fly directly to a Titlark's nest, as to a place with which she was perfectly familiar, though he had never seen her there before, and after raising her head, and looking round, as if to ascertain whether she was noticed or not, she went and deposited her egg in the nest, before the Larks had begun to lay. From these circumstances, and from the direct evidence of my own senses, I consider this fact then as satisfactorily established; and it is of importance, in as much as it completely obviates a difficulty which has greatly perplexed modern ornithologists, and which chiefly induced Colonel Montagu to form his extraordinary, but gratuitous opinion, respecting the power of the Cuckoo to retain its egg till it meets with a nest in a suitable state to receive it.

Though Dr. Jenner enumerates a variety of small birds in whose nests Cuckoos deposit their eggs, yet he remarks, that in Gloucestershire they give a decided preference to that of the Hedge Warbler. In the neighbourhood of Manchester, where Titlarks are numerous, their nests are usually selected for that purpose, and perhaps would be so very generally, were they equally abundant in all situations; as, from being built on the ground, they are much more accessible to so large a bird as the Cuckoo, than that of the Hedge Warbler, which is frequently placed in close, thorn hedges, or thick bushes. If Cuckoos laid in the nests of large birds, their young would not be able to dispossess their companions, and would probably soon perish for want of proper food.

It is now well known, that Cuckoos, in proportion to their size, lay remarkably small eggs, which vary considerably both in magnitude and colour.

The following table exhibits the mean weight of the Cuckoo, and of several birds in whose nests it most frequently lays: also the mean weight of their eggs, with the ratio of the weight of each bird to that of its egg, omitting fractions.

TABLE.

BIRDS.	Mean weight in grains.	Mean weight of their eggs in grains.	Ratio of Birds to their eggs, in weight.
Cuckoo	1925	55	$\frac{1}{35}$
Titlark	289	35	$\frac{1}{8}$
Lesser Fieldlark ...	354	37	$\frac{1}{9}$
Yellow Bunting......	412	43	$\frac{1}{9}$
Hedge Warbler......	332	35	$\frac{1}{9}$
Pied Wagtail.........	333	37	$\frac{1}{9}$

If it be admitted, as I believe it safely may, that Cuckoos lay from four to six eggs, it will not be difficult to furnish data from which a rude estimate may be made of the mean annual destruction occasioned by young Cuckoos among small birds in England and Wales. Early in May, before Cuckoos have begun to breed, and before the foliage of forest-trees has been sufficiently expanded to afford them shelter and concealment, I have known nine or ten of those birds come in an evening to roost among the evergreens in the plantations immediately adjoining our family residence; and as I am certain that all the Cuckoos belonging to the township of Crumpsall, in which it is situated, did not come to roost with us on those occasions, and as it is very probable that I did not see all which did come, I think, though the number of males is reported to exceed that of females, that four will not be considered a high average for the latter in Crumpsall, which contains 3,301,816 square yards, nor three too high as a general average for an equal area; since Dr. Jenner remarks, that Cuckoos are numerous in Gloucestershire, and Colonel Montagu states that they are plentiful in Devonshire;* and I know, from my own observation, that they are much more abundant in many parts of Lancashire, Cheshire, Derbyshire, Staffordshire, Warwickshire, and also in Westmoreland and Cumberland, especially in the neighbourhood of the Lakes, than they are with us. I am informed likewise, that they are very plentiful in Yorkshire, and also in the principality of Wales. The mean number of eggs laid by those birds which are usually

* *Ornithological Dictionary, Introduction*, p. 10.

selected by the Cuckoo to provide for its progeny is five. Now, according to Pinkerton, the area of England and Wales is 49,450 square miles; which, reduced to square yards, gives 153,176,320,000. This, divided by 3,301,816 square yards, the area of the township of Crumpsall, and the quotient multiplied by 3, the mean number of hen Cuckoos for every 3,301,816 square yards, gives 139,173, the mean annual number of female Cuckoos that visit England and Wales; which, multiplied by 5, the mean number of eggs laid by the Cuckoo, gives 695,865, the number of nestlings produced annually by the mean number of females; and this product multiplied by 5, the mean number of eggs laid by those birds to whose care Cuckoos usually intrust their offspring, gives 3,479,325, the mean annual number of nestling birds destroyed by young Cuckoos in England and Wales. Enormous as this destruction appears to be, it is probably rather under than overrated, and when compared with that occasioned by Cuckoos in general, or by our British species alone, in the various countries in which it breeds, it sinks into absolute insignificance.

The injuries, which so frequently happen to the eggs of those birds in whose nests Cuckoos lay, are occasioned, as I have often proved experimentally, by the sitting bird, in attempting to accommodate herself to eggs of different sizes. If comparatively large and small eggs are placed in the same nest, some of the smaller ones are generally thrown out, or rendered addle, by the hen bird, in endeavouring to arrange them so that she may distribute nearly an equal degree of warmth and pressure to all; but the larger ones, which chiefly sustain her weight, and, consequently, are less liable to be moved, usually remain unmolested. When the eggs of birds are exchanged for others of a uniform magnitude, whether larger or smaller than their own, provided the difference is not so great as to occasion them to be forsaken, no disturbance ensues, whatever their colour may be, the change either not being perceived, or totally disregarded; and the young, when extruded, are attended with the utmost care and solicitude.

Cuckoos generally use the precaution of waiting for the absence of small birds from their nests before they venture to lay in them: sometimes, however, their approach is perceived; when the owners immediately make every effort to repel them; but do not always succeed, as the following instance evinces. On the evening of the 24th of June, 1814, I saw a hen Cuckoo alight in a field of mowing grass; when a pair of Titlarks attacked it with such fury, that they pulled several small feathers off it. Their loud cries and violent gesticulations attracted the notice of several people at work near the spot, who, by throwing stones at the Cuckoo, drove it to some distance: however, it soon returned, and, though repeatedly annoyed, persevered till it ultimately accomplished its purpose, by laying in the nest of the Larks. As this bird was on the very eve of its departure, for I did not see a single old Cuckoo that year after the 25th of June, the case was an urgent one, and may account for its unremitted exertions. This fact proves also, how very late in the season Cuckoos' eggs are occasionally laid.

On the 30th of June, 1823, I took a young Cuckoo, which was hatched in a Titlark's nest, on White Moss, on the 28th; seven days after old birds had quitted that neighbourhood; and this nestling, while in my possession, turned both young birds and eggs out of its nest, in which I placed them for the purpose, and gave me an opportunity of contemplating at leisure the whole process of this astonishing proceeding, so minutely and accurately described by Dr. Jenner. I observed, that this bird, though so young, threw itself backwards with considerable force when any thing touched it unexpectedly. It died on the 2nd of July, the fifth day after it was hatched, and then weighed 318 grains.

Young Cuckoos are so very different from adults, that they have been described by several authors as a distinct species. In the colours of their plumage, and in their eyes, they bear some resemblance to young Kestrils; while the old birds, in both these particulars, are very similar to the male Sparrow Hawk after the third or fourth moult. As young Cuckoos do not acquire their mature plumage while they remain in this country, though they are frequently seen here in September, two months later than old birds, and as they are never found in their first feathers on their return in spring, they must moult during their absence; which clearly proves that they are migratory; as it is hardly possible that they should acquire fresh feathers in a state of torpidity. This fact is further corroborated by the early departure of the old birds, which takes place when the temperature is approaching the maximum for the year, and, consequently, when it is much higher than at the time of their arrival; and it is evident that they cannot become torpid with an increasing temperature: indeed, the young birds, which stay so long after them, instead of displaying symptoms of debility and torpor, continue to advance progressively in growth and vigour. Cuckoos, at a mean of fifteen years' observations, appear in this neighbourhood on the 20th of April, when the temperature of the air is 47° in the shade, and quit it on the 27th of June, when the temperature is 59°.

It has been asserted, that Cuckoos sometimes incubate their own eggs, and bring up their own young; but all the instances brought forward in support of this opinion, except one, are totally undeserving of notice; and this might have been passed over without comment also, if Dr. Darwin,* the Hon.

* *Zoonomia,* Vol. 1. p. 172-3.

Daines Barrington,* and the Rev. W. Bingley,† had not seemed to consider it conclusive and incontrovertible. The circumstance is thus related by Darwin. "As the Rev. Mr. Stafford was walking in Glossop Dale, in the Peak of Derbyshire, he saw a Cuckoo rise from its nest. The nest was on the stump of a tree, that had been some time felled, among some chips that were in part turned grey, so as much to resemble the colour of the bird. In this nest were two young Cuckoos: tying a string about the leg of one of them, he pegged the other end of it to the ground, and very frequently for many days beheld the old Cuckoo feed these her young, as he stood very near them." That Mr. Stafford must have been mistaken needs scarcely to be insisted on, since Dr. Jenner has shown, that when two young Cuckoos happen to be hatched in the same nest, the stronger invariably turns out the weaker. The nest which Mr. Stafford found, from the number of young it contained, most probably belonged to a Goatsucker, as I know that this species, which seldom lays more than two

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* *Miscellanies*, p. 255.

† *Animal Biography*, Vol. 11. p. 299, 300.

or three eggs, breeds in the neighbourhood of Glossop; and it might easily be mistaken for a Cuckoo, by a person not very familiar with birds, who had only an opportunity of observing it at a distance. If this gentleman had been a skilful ornithologist, would he not have endeavoured to remove every possibility of doubt in a matter which, it is evident, greatly excited his interest, by examining and describing the structure of the feet of these young birds?

Male Cuckoos, a short time before they retire, entirely lose their cry, and this loss is generally preceded by stammering and a difficulty of utterance. Now as most of our Singing Birds become mute in autumn, solely from inability to continue their songs, as is manifest from their unavailing efforts to prolong them; whatever occasions their silence, most probably occasions that of the Cuckoo also; and I conceive that an efficient cause will be found in the propagation of their species, and in the decrease of their food, which, by relaxing the vocal organs, renders them incapable of obeying the dictates of the will. The well known cry of the male Cuckoo is frequently heard in the night.

Various are the modes of accounting for the peculiarities of the Cuckoo adopted by different writers on the subject. Some, who have turned their attention particularly to the anatomy of this bird, think they have discovered a satisfactory reason for its not hatching its own eggs, in the largeness and protuberance of its stomach, which, they hastily conclude, must render the act of incubation difficult, if not impracticable ; but when we consider that several birds, as the Owl, Goatsucker, &c., whose stomachs are, in those respects, similar to that of the Cuckoo, do incubate their own eggs, the insufficiency of this imaginary cause will be very apparent.

Buffon supposes that female Cuckoos lay their eggs in the nests of other birds, to prevent the males, which he states occasionally prey upon eggs, from destroying them.* The chief objection to this supposition arises from the deficiency of evidence in support of this charge brought against the males.

According to the *Physiognomical System of Drs. Gall and Spurzheim*, Cuckoos transfer

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* *Histoire Naturelle des Oiseaux.* Tome sixième.

the care of their progeny to strangers, in consequence of the imperfect developement of certain cerebral organs, termed, by those authors, organs of constructiveness and philoprogenitiveness, whose functions are thus necessarily circumscribed. I shall not here discuss the merits of this system, which, notwithstanding the ridicule that is bestowed upon it, is at least entitled to a patient and candid investigation, but shall proceed to consider the reason assigned by Dr. Jenner for the singularities of the Cuckoo. This gentleman conjectures, as I have already stated, that the short stay which Cuckoos make in this country is the true reason why they do not bring up their own young, as the parent birds would be impelled, by a desire to migrate, to quit their progeny before they were able to provide for themselves. This hypothesis, as regards the British species, certainly has an appearance of plausibility: in what degree it is applicable to foreign species, of which Dr. Latham, in his *General History of Birds*, enumerates about 87, besides varieties, is an interesting inquiry, which our present very imperfect knowledge of their habits and economy will not permit us to answer. Dr. Latham, indeed, does not particularize more than five or six species belonging to this extensive genus, which lay in the nests of other birds; nor more than twice that number which bring up their own young; and of the manners and propensities of the rest we are almost entirely ignorant.

It is reported that the Cowpen Bird, a species perfectly distinct from the Cuckoos, has many of their most remarkable peculiarities, intrusting the care of its offspring to strangers, and laying only one egg in the same nest. Dr. Darwin, in *Zoonomia*, maintains that the propensities of the Cuckoo to lay in the nests of other birds, and to migrate, are not instinctive; and goes so far as to reflect upon the reasoning powers of those who entertain a contrary opinion. But the Doctor, though a profound scholar, and a close observer of nature, was not infallible; and it would be easy to point out numerous errors into which he has fallen, in his very ingenious and amusing work, especially in the section on instinct. I shall, however, in this instance, content myself with exhibiting the erroneousness of his opinions respecting the Cuckoo; which will be best done by tracing the progress of an individual of that species, from its extrusion from the egg, till it arrives at maturity, or begins to propagate its kind; since an examination of its various means of acquiring information on those subjects which are of the greatest importance for it to know, will furnish the surest criterion of what is due to nature, and what to observation and tuition. Let us suppose then, that a Cuckoo's egg is hatched in the nest of a Titlark about the middle of June. No sooner is the young bird disengaged from the shell, than a disposition to eject whatever happens to be in the nest with it begins to manifest itself; and as young Cuckoos increase in size and strength very rapidly, it is soon enabled to turn out the nestling Larks, which are suffered to perish within a few inches of the nest, being entirely abandoned by their parents. Now, to what cause, I would ask, must we attribute this extraordinary propensity, which shows itself so early? As Titlarks do not possess it, and as old Cuckoos, after they have deposited their eggs in suitable nests, interest themselves no further about their progeny, it is evident that it cannot be acquired from them; it must, therefore, be perfectly innate. It may be remarked also, that the chirp of young Cuckoos is the same, as Dr. Jenner rightly observes, whatever the species of their foster parents may be: hence it follows that it is not learned from any other bird, but is exclusively their own. After remaining in the nest about three weeks, this young bird deserts it early in July, and begins to acquire the use of its wings; but the care of the Titlarks is not entirely discontinued till towards the middle of August; when, having obtained a considerable command of wing, a desire to migrate prompts it to leave the country. The instinctiveness of this impulse one would be inclined to believe could not admit of a doubt; for Titlarks are not birds of passage, and as old Cuckoos depart late in June, or early in July, it is clear that young ones cannot derive any benefit from their experience: yet Darwin maintains, that migration among birds is as much an acquired art as navigation is among men. With regard to the Cuckoo, I trust that I have said sufficient to convince every impartial inquirer, that it is actuated in this particular purely by instinct; and, reasoning from analogy, I should be led to conclude that this is the case with all Migratory Birds without exception. But to return to the Cuckoo. Early in the ensuing spring, it revisits the country where it was bred, or seeks another equally well suited to its habits and necessities. If a male bird, its well known cry, which is now heard for the first time, and which I need scarcely observe cannot have been taught it, at once distinguishes its sex. If a female, it is solicitous, after impregnation, to secure a suitable asylum for its offspring; and here, though Darwin denies it, the operations of instinct are most strikingly manifested. Without any previous instruction, it discovers the nests of other birds, though it constructs none itself, by watching the birds build them; and selecting such only, as from the size of the owners, and their manner of feeding, are best adapted to afford security to its eggs, and proper nourishment for its young; it lays, just when the small birds themselves begin to lay, a single egg in each, till it has produced its appropriate number; as if aware of the consequences which would ensue, were two or more eggs deposited in the same nest.

Having, in this hasty sketch, shown that the instinctiveness of the most remarkable propensities of the Cuckoo admits of direct proof; it follows, that the notion of the peculiarities of this extraordinary bird being acquired must be relinquished as quite untenable.

I may observe, in conclusion, that the history of the Cuckoo, by the evident marks of design which it displays, in the admirable adaptation of means to ends, affords a convincing proof of the existence of a First Principle of causation, the mysterious source of all that is good and beautiful in nature.

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ADDITIONAL OBSERVATIONS

ON THE

CUCKOO.

In the *Gentleman's Magazine* for April, 1806, two instances are recorded of young Cuckoos having been occasionally fed by large numbers of birds of the same species as their foster parents. It is stated that one of these nestlings was sometimes supplied with nourishment by upwards of twenty Titlarks, and that the other frequently received similar attentions from forty-eight Wagtails. From these facts the writer of the article concludes, that birds which have the care of young Cuckoos are not always able to provide them with a sufficiency of food, and that on such occasions they procure the assistance of their neighbours of the same kind as themselves.

Colonel Montagu, in the *Supplement to the Ornithological Dictionary*, calls in question the accuracy of these observations, and conjectures that the object of birds in thus assembling about nestling Cuckoos is not to administer to their necessities, but to assault and persecute them.

I have been favoured with a communication from Mr. Eaton, of York, which places the subject under consideration in a somewhat different light from that in which it has been viewed by any preceding ornithologist. Mr. Eaton informs me that in the summer of 1827, Captain Porter, who resides near the city of York, discovered a Hedge Warbler's nest in his garden, containing a young Cuckoo only; the nestling Hedge Warblers, all of which had been ejected by this formidable intruder, being found dead near the spot. The nest and its occupant were taken by the Captain and put into a cage, which was placed on the summit of a pole in the garden. In this situation the foster parents speedily visited their captive charge, and, resuming their attentions, continued to feed it with great assiduity; but their most strenuous exertions failing to satisfy its increasing voracity, a third Hedge Warbler was induced to co-operate with them in the arduous undertaking. As the young Cuckoo advanced in growth, a still more ample provision of food became requisite, and a Spotted Flycatcher lent its assistance also in supplying the urgent demands of its appetite.

It may be here remarked, that the purpose of these birds in visiting the young Cuckoo, from the numerous observations which were made upon them, and the favourableness of the situation and circumstances for ensuring accuracy, could not be mistaken.

I shall now proceed to notice the most novel and important fact detailed in Mr. Eaton's interesting narration, namely, the assistance afforded by the Spotted Flycatcher. "How," Mr. Eaton inquires, "could a pair of Hedge Warblers prevail upon a bird of a different species to contribute to the support of their supposititious offspring?" Were the case as the question necessarily supposes it to have been, it certainly would present a great difficulty; for the feathered tribes, though capable, in some instances, of connecting vocal sounds with the ideas intended to be signified by them, do not possess an artificial language: but I am inclined to think that the Hedge Warblers did not intentionally exercise any influence whatever over their coadjutor.

Nestling Cuckoos, it is well known, are extremely clamorous when powerfully stimulated by hunger: indeed their cry for food is so incessantly repeated on such occasions, that it frequently leads to their discovery. Now this, I believe, is the exciting cause, which, by calling into operation the parental affections of birds so circumstanced as to be influenced by it, impels them to succour the young of strangers, even when they have not been placed under their immediate care; and the most probable reason which suggests itself, why so many individuals of a kind are sometimes associated together in the performance of the same task, is that they are attracted by each other's calls.

The following anecdotes support these opinions.

A nestling Greenfinch was placed in the same cage with an adult Lesser Redpole, which brought it up with the utmost care.

Several young Sparrows, whose nest had been destroyed, were put into a small basket by a lady who pitied their helpless condition, and the basket was then conveyed to the grass-plot in front of her house. In this situation they soon became clamorous for food, and a great variety of birds hastened to the spot, many of which were observed to supply them with nourishment; but unfortunately they soon perished, probably from a deficiency of warmth, as they had not been hatched many days, and were almost destitute of covering.

"The sons of Mr. Lord, of Ramsey, Essex, took four young Ravens from a nest, and put them into a waggon in a cart-shed. About the same time they destroyed the young of a Magpie which had its nest near the cart-shed, and the old Magpies, hearing the young Ravens crying for food, carried them some, and constantly fed them till they were disposed of by the boys." *Trans. Linn. Soc.*, Vol. XV, p. 10.

I have thus attempted to show, contrary to the opinion of Montagu, that the author of the article in the *Gentleman's Magazine* is perfectly correct in asserting that young Cuckoos are occasionally fed by a more than ordinary number of birds; but that it is erroneous to suppose that these numerous purveyors are invariably of the same species as the foster parents of the Cuckoos, and that their proceedings are influenced entirely by the latter.

The belief that the Cuckoo sometimes constructs a nest, and brings up its own young, has been maintained by several intelligent naturalists; and is at present entertained by that excellent zoologist, Dr. Fleming, as is evident from the following passage, extracted from the remarks on that bird given in his recently published *History of British Animals.* "In some cases, however," he observes, "it appears that the Cuckoo constructs its own nest. Thus, in a manuscript of Derham's, on Instinct, communicated by Pennant to Barrington, it is stated, that 'the Rev. Mr. Stafford was walking in Glossop Dale, in the Peak of Derbyshire, and saw a Cuckoo rise from its nest, which was on the stump of a tree, that had been some time felled, so as much to resemble the colour of the bird. In this nest were two young Cuckoos, one of which he fastened to the ground, by means of a peg and line, and very frequently, for many days, beheld the old Cuckoo feed these her young ones.'"

In my observations on the Cuckoo, page 82, I have pointed out several circumstances which completely invalidate Mr. Stafford's account, to which, unfortunately, so much importance has been attached; and it is gratifying to find that the conclusions there arrived at are supported by Dr. Jenner, whose opinion will command attention, in the view he takes of the subject in his *Essay on the Migration of Birds.**

Another supposed instance of a Cuckoo having incubated its eggs and nourished its young, which had escaped my former researches, is given in the octavo edition of *Zoonomia*,† in an extract from a letter written by the Rev. Mr. Wilmot, of Morley, near Derby; and as it is deserving of attention, I shall transcribe the entire passage. "In the beginning of July, 1792," Mr. Wilmot writes, "I was attending some labourers on my farm, when one of them said to me, 'there is a bird's nest upon one of the coal-slack hills; the bird is now sitting, and is exactly like a Cuckoo. They say that Cuckoos never hatch their own eggs, otherwise I should have sworn it was one.' He took me to the spot; it was in an open fallow ground; the bird was upon the nest; I stood and

* *Transactions of the Royal Society* for 1824.

† See the *section on Instinct*, p. 246, et seq.

observed her some time, and was perfectly satisfied it was a Cuckoo: I then put my hand towards her, and she almost let me touch her before she rose from the nest, which she appeared to quit with uneasiness, skimming over the ground in the manner that a hen Partridge does when disturbed from a new hatched brood, and went only to a thicket about forty or fifty yards from the nest; and continued there as long as I stood to observe her, which was not many minutes. In the nest, which was barely a hole scratched out of the coal-slack, in the manner of a Plover's nest, I observed three eggs, but did not touch them. As I had labourers constantly at work in that field, I went thither every day, and always looked to see if the bird was there, but did not disturb her for seven or eight days, when I was tempted to drive her from the nest, and found two young ones, that appeared to have been hatched some days, but there was no appearance of the third egg. I then mentioned this extraordinary circumstance (for such I thought it) to Mr. and Mrs. Holyoak, of Bidford Grange, Warwickshire, and to Miss M. Willes, who were on a visit at my house, and who all went to see it. Very lately I reminded Mr. Holyoak of it, who told me he had a perfect recollection of the whole, and that considering it a curiosity, he walked to look at it several times, was perfectly satisfied as to its being a Cuckoo, and thought her more attentive to her young than any other bird he ever observed, having always found her brooding her young. In about a week after I first saw the young ones, one of them was missing, and I rather suspected my plough-boys having taken it, though it might possibly have been taken by a Hawk some time when the old one was seeking food. I never found her off her nest but once, and that was the last time I saw the remaining young one, when it was almost full feathered. I then went from home for two or three days, and when I returned the young one was gone, which I take for granted had flown. Though during this time I frequently saw Cuckoos in the thicket I mention, I never observed any one that I supposed to be the cock bird paired with this hen."

This case, so circumstantially detailed, and attested by witnesses of such high respectability, certainly has an imposing appearance ;

but a glance at the particulars intended to establish its accuracy is sufficient to convince every ornithologist who is familiar with the economy of the Cuckoo, that the nest discovered by Mr. Wilmot's labourer did not belong to a bird of that species: indeed, from its situation and contents there can scarcely be a doubt that it was a Goatsucker's. We are informed by Mr. Wilmot, that in the beginning of July this nest contained three eggs, two of which were hatched several days after his attention was first directed to them; and that the parental duties of the mother towards her offspring were duly exercised till her last remaining nestling, one having been removed by some unknown cause, was nearly full feathered, which could not have been less than eighteen or twenty days from its extrication from the egg. These, it will appear, are important facts; for, as old Cuckoos quit this kingdom early in July,* they plainly show that Mr. Wilmot's observations, and those of his friends, must have been made under the delusive

* Old Cuckoos depart from the neighbourhood of Manchester on the 27th of June, at a mean of fifteen years' observations.

influence of false impressions; and this opinion is confirmed by the peaceable manner in which the young birds occupied the nest while they continued together. Perhaps it may be imagined by those to whom the arguments already advanced do not appear conclusive, that the maternal affection of the parent bird induced her to remain so much beyond the time at which adult Cuckoos usually retire: but this hypothesis will not remove a single difficulty; for Mr. Wilmot expressly states that during that period he frequently saw Cuckoos in an adjoining thicket, though he never observed any one which he supposed to be the mate of this female. Had Mr. Wilmot been a skilful ornithologist, he would not have failed to examine the structure of the feet of these nestlings, as he must have been well aware that by so doing he might have completely established the truth or fallacy of his supposition. It is almost unnecessary to insist upon the caution with which statements should be received from persons whose information does not qualify them to discuss the subjects upon which they write. The error into which Mr. Wilmot has fallen, being evidently occasioned by his imperfect acquaintance with the feathered tribes, for it is pretty clear that he did not distinguish Goatsuckers from Cuckoos, now that the economy of the latter species is better understood, will probably mislead none, except those who are ignorant of natural history, or greatly deficient in reflection; but that so distinguished a zoologist as Dr. Fleming should have contributed to extend and perpetuate the mistaken notion here controverted, by lending it the sanction of his authority, is to be regretted.

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ON THE

OCCASIONAL DESERTION OF THEIR PROGENY

BY BIRDS OF THE

SWALLOW TRIBE.

THE late celebrated Dr. Jenner, in a posthumous *Essay on the Migration of Birds*, published in the first part of the *Transactions of the Royal Society* for 1824, has briefly adverted to an extraordinary occurrence in the domestic economy of two species of British Hirundines; which, though far from uncommon, has either been altogether overlooked, or totally disregarded, by every preceding writer on ornithology whose works I have had an opportunity of consulting. The circumstance alluded to is the occasional desertion of their last hatched broods by the Swallow and House Martin. This singular fact, with which I was familiar previously to its enunciation by Dr. Jenner, my own researches confirm and illustrate; I shall, therefore, without further prelude, proceed to state the results obtained from them.

The Swallow appears in the neighbourhood of Manchester on the 15th of April, and the House Martin on the 25th of the same month, at a mean of fifteen years' observations; but as those birds do not pair immediately on their arrival, and as they generally produce two, and often even three broods in a season, it frequently happens that individuals have nestlings in October, the period at which the great body of their species withdraws from this country.* Many of these young birds, from inability to accompany their congeners in their autumnal flight, are compelled to remain behind, and some of the most vigorous of them may occasionally be seen, in favourable situations, lingering about till the close of November, endeavouring to obtain a scanty subsistence. As the temperature of the atmosphere decreases, however, the insects they prey upon gradually diminish; till, at last, their utmost exertions

* At Tarvin, in Cheshire, in 1819, I saw a pair of House Martins feeding their unfledged young on the 20th of October.

to procure a sufficient supply of food are unavailing: they then speedily become enfeebled, and concealing themselves, as is usual in such emergencies, numbers undoubtedly perish from exhaustion. A few accidental discoveries of birds thus situated, before the vital principle has been quite extinct, may, very possibly, have given rise to the opinion that European Swallows pass the winter season in a state of torpidity.

It did not come to my knowledge, that these late broods are sometimes deserted by the parent birds, before they are capable of providing for themselves, till the spring of 1821; when a pair of House Martins, after taking possession of a nest which had been constructed in the preceding summer, drew out the dried bodies of three nearly full fledged nestlings which had perished in it, preparatory to appropriating it to their own purposes. About the same time, and near the same spot, a similar attempt was made by another pair of House Martins; but all their efforts to dislodge the young proving ineffectual, they entirely closed up the aperture with clay, and so converted the nest into a sepulchre.

At first I was disposed to attribute the untimely fate of the nestlings, thus unexpectedly discovered, to the accidental destruction of one or both of their parents; but a little reflection induced me to change my opinion. So many instances were called to mind of the sudden departure of House Martins, at periods when, to all appearance, they were most busily engaged in providing for their families, that what before was regarded as the unavoidable consequence of a fortuitous circumstance, I now began to suspect might be occasioned by a voluntary act of desertion.

In order to clear up this doubtful point, an examination of a considerable number of Swallows' and House Martins' nests was immediately resolved upon; but, as the breeding season had then commenced, it was deemed advisable, on more mature deliberation, to defer the undertaking until its termination: accordingly, the search was postponed to the 27th of October, when, on being carried into effect, several nests, of both kinds, were found to contain dead young ones. Satisfied that a fact of such frequent occurrence could not, with any degree of probability, be ascribed to accident, and convinced that the intentional desertion of their progeny by the parent birds afforded the only adequate explanation of it which was admissible, no further inquiry into the matter took place till November, 1825. On the 19th of that month, an intelligent person, to whom I am indebted for numerous interesting communications, relative to the natural productions of the neighbourhood in which he resides, assured me the suspicion I had formerly intimated to him, that House Martins frequently leave their last hatched broods to die of hunger in the nest, was perfectly well founded. Having narrowly watched the proceedings of those birds, many of which breed annually under the eaves of a large barn situated near his house in the chapelry of Blakeley, the result of his investigation, he informed me, was the complete confirmation of my supposition by the most unequivocal proof; namely, that obtained directly from personal observation of the fact; and he did not doubt, he remarked, that dead nestlings might then be procured in abundance, if I would take the trouble to have the nests at the barn examined. This suggestion was acted upon without delay:

repairing directly to the place, a ladder was quickly provided, and fourteen nests underwent a careful inspection; of these, five were found to contain dead nestlings of various sizes,* and from another, two eggs were taken, whose contents very evidently showed that they had been forsaken when on the point of being hatched. The nestlings collected on this occasion did not, it is true, exceed ten; which may be thought few when compared with the number of nests they occupied; but the second and third sets of eggs, produced by those House Martins which lay several times in a season, it should be recollected, only average three and two respectively; and even these may not all be prolific.

The Sand Martin, I believe, has never been suspected of forsaking its progeny; yet, that it sometimes does abandon them, I have clearly ascertained, by repeated inspections of the nests of that species during the winter months.

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* The extremely flattened appearance of some of these young birds, especially the smaller ones, which I was quite unable to account for, greatly excited my attention. I soon learned, however, that it was occasioned by the pressure of the Sparrows which every night took up their lodgings in the nests.

Whether the Swift, whose general habits are so dissimilar to those of the British Hirundines, ever deserts its young, I have not been able to determine; as it is rather a scarce bird in the neighbourhood of Manchester, and usually builds its nest in situations to which I have no access. That this may sometimes happen, however, in cases of extreme urgency, seems probable from an anecdote related by Mr. White, in his *Natural History of Selborne*, letter 52. "I have just met with a circumstance respecting Swifts," says that pleasing writer, "which furnishes an exception to the whole tenor of my observations, ever since I have bestowed any attention on that species of Hirundines. Our Swifts, in general, withdrew this year (1781) about the first day of August, all save one pair, which in two or three days was reduced to a single bird. The perseverance of this individual made me suspect that the strongest of motives, that of an attachment to her young, could alone occasion so late a stay. I watched, therefore, till the twenty-fourth of August, and then discovered, that, under the eaves of the church, she attended upon two young, which were fledged, and now put out their white chins from a crevice. These remained till the twenty-seventh, looking more alert every day, and seeming to long to be on the wing. After this day, they were missing at once; nor could I ever observe them with their dam coursing round the church, in the act of learning to fly, as the first broods evidently do. On the thirty-first, I caused the eaves to be searched, but we found only two callow, dead Swifts, on which a second nest had been formed." Now, although the maternal affection of the female bird, in the instance before us, was sufficiently powerful to induce her to remain with her young, till they were capable of accompanying her in a distant journey, to a more genial climate, as is sometimes the case with House Martins, when deserted by their mates; yet the conduct of the male, if it does not absolutely establish the fact that Swifts occasionally abandon their offspring to destruction, certainly affords strong presumptive evidence in its favour.

The frequent desertion of their last hatched broods by the Swallow, House Martin, and Sand Martin, which is too well authenticated to admit of a doubt, must appear surprising to every one; but particularly so to those who are aware, how highly the parental feelings of the feathered tribes are excited during the breeding season. Few people are ignorant of the care and attention bestowed upon their offspring by our Domestic Fowls; and that the winged inhabitants of the fields and woods are, in their wild state, no less attached to their progeny than the reclaimed inmates of the poultry-yard, may be inferred from the following examples.

Early in August, 1825, a neighbour took a young Cuckoo out of a Titlark's nest; and, carrying it home with him, put it into a cage, which he hung in a pear-tree in his garden. The foster parents, speedily discovering where their nursling was confined, notwithstanding the distance of the place from its former abode could not be less than three-quarters of a mile, proceeded, with every demonstration of delight, to supply its immediate wants, and continued to provide it with food till it was unfortunately killed by a cat, though there never was the least probability that it would be restored to liberty.

A still more extraordinary account is given by Montagu in the *Introduction to the*

Ornithological Dictionary, p. 33, and following, of some Golden-crested Wrens, which were brought up in captivity by the parent birds. The narrator took the nest, he informs us, when the young were about six days old, and, putting it in a small basket, enticed the old ones by degrees to his study window. After allowing them sufficient time to become familiar with that situation, he placed the basket within the window, and then at the opposite side of the room. It is remarkable, he observes, that, although the female seemed regardless of danger, from her affection for her offspring, yet the male never once ventured into the room, though he constantly fed the young birds while they were at the outside of the window. The female, on the contrary, would feed them at the table at which he sat, and even when he held the nest in his hand, provided he remained motionless; but, on moving his head one day, while she was on the edge of the nest, she made a precipitate retreat, mistook the closed for the open part of the window, knocked herself against the glass, and fell breathless on the floor, where she lay for some time. However, recovering a little, she made her escape; and, in about an hour after, he was agreeably surprised by her return, and she would afterwards frequently feed the young while he held the nest in his hand.

The Partridge has generally been represented by ornithologists as possessing a more than ordinary share of affection for its offspring, and the anecdote I am about to relate tends greatly to corroborate this idea. A near relation of my own* was told by the late Rev. W. Evans, of Mayfield, near Ashburn, that, some years since, his men, who were employed in cutting a field of mowing-grass, brought him a hen Partridge which they had caught on her nest. Being desirous to save the eggs from destruction, he ordered that they should be removed to his house, and placed on some hay in an unoccupied room, intending to put them under the care of a Domestic Hen; but wishing to know whether the parent bird would take any notice of them in that novel situation or not, he directed that she should be set down near them; when, to his great astonishment, she

* John Blackwall, Esq., of Blackwall, Derbyshire.

immediately ran to the spot where they were deposited, and, covering them with the utmost care, continued to sit till they were hatched. At first she was unremitting in her attention to her young, many of which were ultimately reared and set at liberty, but her anxiety to regain her freedom evidently increased with their growth; and, as soon as her assistance could be dispensed with, she was suffered to make her escape. This instance is the more remarkable, as the Partridge has never been known to breed in captivity.

In a conversation which I had with Dr. Dalton, in the summer of 1822, on the force of that impulse which leads birds to sit upon their eggs with so much patience and assiduity, he informed me that he had removed hen Redbreasts from their nests, during the period of incubation, and that, upon gently replacing them, they had continued to sit as if they had not been disturbed. This experiment of Dr. Dalton's, which affords a striking instance of one of the most constant and powerful dictates of nature, self-preservation, being counteracted by a temporary excitation of superior energy, I have repeated with the Redbreast, Whinchat, Swallow, House Martin, the Marsh, Cole, and Great Titmice, &c., not only when they have been sitting, but also when they have had small young ones, and almost always with success.

These examples, to which many more might easily be added, will be sufficient, I am persuaded, to convince every unprejudiced mind, that the parental affections of the feathered tribes in general, and, what is more immediately to the purpose, of the Swallow and House Martin in particular, are powerfully excited during the breeding season. Now, what, we may ask, can induce the two last-named species, and the Sand Martin, deliberately to consign their offspring to a painful and lingering death, in direct opposition to such intense feelings as these? The cause assigned by Dr. Jenner, for conduct so anomalous, is the desire to migrate; and this desire, he maintains, is produced by a change in the reproductive system; which, in the case of the birds under consideration, is supposed to take place prematurely. I say is supposed to take place, for I do not see how it is possible to ascertain what individuals will desert their progeny before they carry their intention into effect, and after the accomplishment of the act, no opportunity of examining the internal state of their organization can present itself; this notion, therefore, it is pretty obvious, must have originated in conjecture. That the sudden departure of the Swallow, House Martin, and Sand Martin, under circumstances so peculiar as those we have been contemplating, is occasioned by the desire to migrate, I do not dispute; but that this desire results from certain changes which occur periodically in the condition of the reproductive system seems to be quite inadmissible. Indeed, the undeniable facts, that every species of the feathered tribes, though subject to those changes, is not migratory; and that Snipes, Wild Ducks, &c., breed annually, and Woodcocks occasionally, in countries where the majority of those birds is known to sojourn during the winter only, are so totally subversive of Dr. Jenner's hypothesis, that to attempt a more complete refutation of it, in this place, would be superfluous.

It is particularly deserving of remark, that the early death which invariably terminates the sufferings of those devoted nestlings that are abandoned by their parents, powerfully militates against an opinion, prevalent amongst ornithologists of the present day, that many of our Summer Birds of Passage, especially the Swallows, are capable of passing the winter season in a state of torpidity; for, if this belief in the liability of the European Hirundines to become torpid in autumn be well founded, how does it happen, that late hatched broods of Swallows, House Martins, and Sand Martins, when deserted, uniformly perish; even under circumstances which are represented as rendering individuals of their species, too young or feeble to undergo the fatigues of migration, merely dormant? The advocates of torpidity will do well to consider this difficulty with attention; since, if not removed, it leaves them no alternative but to renounce, as untenable, the doctrine they maintain.

Since the foregoing observations were made on the occasional desertion of their last hatched broods by several species of British Hirundines, a favourable opportunity of pursuing the investigation has again presented itself.

On the departure of the House Martins, in October, 1826, it was perceived that they left some broods to perish in the nests built under the eaves of a barn, situated at the Hill-top, in the chapelry of Blakeley; the edifice being that to which I have before alluded as a favourite haunt of those birds. This occurrence determined me to have the nests carefully examined: accordingly, after procuring the requisite assistance, a minute inspection of the whole, twenty-two in number, took place on the 11th of November; when, to my great surprise, thirteen were discovered to contain eggs and dead nestlings. With regard to the particulars, which are annexed, it is only necessary to remark, that the nests are denoted by the progressive numbers; and that the state of the contents, as there described, is the same in which they were left by the parent birds.

NESTS IN WHICH EGGS WERE FOUND.

NESTS.	CONTENTS.
No. 1	Three Eggs which had not been sat upon.
2	One Egg which had not been sat upon.
3	Five Eggs which had been sat upon a short time.
4	Four Eggs which had been sat upon a considerable time.
5	Three Eggs on the point of being hatched.
	Sixteen, Total.

NESTS IN WHICH YOUNG BIRDS WERE FOUND.

NESTS.	CONTENTS.
No. 6	Two Nestlings newly disengaged from the egg.
7	Three Nestlings a few days old.
8	Two Nestlings about a week old.
9	Two Nestlings nearly half grown.
10	Two Nestlings about three parts grown.
11	Two Nestlings nearly fledged.
12	Five Nestlings nearly fledged.
13	One Nestling quite fledged.
	Nineteen, Total.

From the unusual quantity of eggs and young deserted by the House Martins on this occasion, it may be inferred, that the desire to perpetuate their species was protracted, in a more than ordinary number of individuals, to the termination of their stay in this country, by the high temperature of the season,* and the great abundance of food consequent upon it.

The circumstance of fresh laid eggs being in several instances forsaken, furnishes an additional argument to those previously urged against the hypothesis advanced by Dr. Jenner, that a premature change uniformly takes place in the physical condition of the reproductive system of those birds which abandon their progeny to destruction; for it is in the highest degree improbable, that an organic change, sufficient to induce a total alienation of parental affection; a change, let it be remembered, which, in every observed case, has been found to proceed gradually, should so suddenly succeed to the extremely active state of the system indicated by the recent production of prolific eggs. The simultaneous departure of both sexes also, when they desert their offspring, which, as far as my own researches extend, appears to occur with great regularity, is too remarkable a fact to be accounted for on a principle so

* On referring to my Meteorological Journal, I find, that the mean temperature of the months of June, July, and August, respectively, was higher in 1826, than in many preceding years.

uncertain in its operation as that maintained by Dr. Jenner.

A belief, represented by Dr. Fleming, in his *Philosophy of Zoology*, Vol. II, pages 72—3, as prevalent throughout Scotland, that Swallows are sometimes found torpid in their nests, has, most likely, originated in the discovery of the forsaken young of the Swallow and House Martin, (for both species are termed Swallows, indiscriminately, by the multitude,) in a perishing condition, or dead.

It appears from the following passage, extracted from Pennant's *British Zoology*, Vol. II, page 155, that the Puffin, when placed under circumstances similar to those which induce birds of the Swallow tribe to desert their offspring, sometimes abandons its progeny. "The first young (of the Puffin) are hatched the beginning of July. The old ones shew vast affection towards them, and seem totally insensible of danger, in the breeding season. If a parent is taken at that time, and suspended by the wings, it will, in a sort of despair, treat itself most cruelly, by biting any part it can reach, and when it is loosed, instead of escaping, will often resort to its unfledged young. This affection ceases at the stated time of migration, which is most punctually about the eleventh of August, when they leave such young as cannot fly, to the mercy of the Peregrine Falcon, who watches the mouths of the holes for the appearance of the little deserted Puffins, which, forced by hunger, are compelled to leave their burrows."

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ON THE

INSTINCTS OF BIRDS.

THE manners and economy of the inferior orders of animals form one of the most interesting subjects of investigation which can engage the attention of the philosophic naturalist. An acquaintance with this important but greatly neglected branch of zoology, conduces to the correction of numerous erroneous opinions and groundless prejudices, and opens an inexhaustible source of valuable information and rational amusement. It throws much light also on the operations of that mysterious agency, which regulates those actions of animated beings that, although attended with consciousness, do not result from observation, instruction, experience, or reflection, and have, therefore, generally been termed *instinctive actions.*

When we consider how many creatures are objects of superstitious dread or veneration, and what multitudes, even in this enlightened age and country, are sacrificed annually to mistaken notions of their mischievous properties, reason and humanity are alike shocked; and we deeply deplore the prevalence of errors, which the zealous promulgation of more correct ideas and liberal sentiments can alone effectually remedy.

That useful bird, the White Owl, which, on account of the great number of mice it destroys, ought to be carefully protected by the farmer, is frequently looked upon with terror as a forerunner of death, which it is supposed to announce by its loud and dissonant screams; and a small Coleopterous insect, the *Anobium tessellatum* of entomologists, has obtained the appellation of death-watch, from a fancied connexion between the ticking sound it produces, and that awful event. The Raven and Magpie are imagined, by persons of weak intellects and timid dispositions, to prognosticate evil; and this notion has been extended and perpetuated by the allusions made to it in numerous legendary tales, and in the writings of our poets. To take the life of the Swallow, or House Martin, or to disturb their nests, is regarded as an unlucky event, portending disaster to the unfeeling aggressor; and the Redbreast and Wren owe much of their security to popular prepossessions equally without any rational foundation. Many birds, which subsist almost entirely on insects, as the Cuckoo, Redstart, and Flycatcher, are shot by ignorant gardeners and nurserymen, indiscriminately with those species which feed principally on the seeds of plants and other vegetable productions. The Goat-sucker and the Hedgehog are falsely accused of sucking the teats of animals, and a price, usually paid out of the parish rates, is still given for the latter in many parts of England;* and those beautiful and harmless

* Sixpence a head, I am well informed, has been recently obtained for Hedgehogs in this parish. Now it is truly disgraceful, that any portion of the public money should be expended to encourage the destruction of an inoffensive animal, which derives its support from insects and vegetables, because, in the absurd opinion of the vulgar, it is injurious to cattle.

reptiles, the Common Snake and Blind-worm, are destroyed without pity, upon the groundless supposition that they are venomous.

These are a few instances only, selected from many that have fallen under my own observation, of the pernicious consequences which result from an ignorance of that useful portion of natural history, which at present engages our consideration.

We will now proceed to notice briefly, some of the numerous advantages to be derived from a successful cultivation of that delightful study; and a correction of the above mentioned errors and abuses, with the needless waste of life which it would prevent, is not among the least of them. For the preservation of our persons and property from those creatures by which they are liable to be injured; for the best methods of promoting the increase, improving the condition, and effecting the subjection of such as contribute to our benefit or amusement; and for the skilful management of our valuable reclaimed and domestic animals, which supply us with so many comforts and luxuries, we must depend, in a great measure, upon our knowledge of their habits, manners, and propensities. To this knowledge also, the practical physiologist is indebted for a means of enlarging his acquaintance with the phenomena of life; the scientific naturalist, and particularly the ornithologist, for an excellent mode of distinguishing species, under circumstances in which the ordinary rules for determining them are of little or no avail; and the physico-theologist, for a more comprehensive view of the power, wisdom, and goodness of the Creator as manifested in his living works.

Having thus succinctly adverted to the great importance of accurate information in this extensive department of zoology, I shall now limit my remarks exclusively to the feathered tribes; and whoever attentively considers the diversified operations of the various active powers, with which the interesting beings that compose that pleasing division of the animal kingdom are endowed, cannot fail to receive a high degree of mental gratification.

It frequently happens, that the experienced observer is enabled to discriminate birds with the utmost certainty by their notes, manner of flight, or some other peculiarity, when he has no opportunity of procuring specimens of them, or of ascertaining the colours of their plumage. Indeed, in this last particular, distinct species, as the Yellow Wren, Lesser Pettychaps, several of the Larks, Finches, &c., so nearly resemble each other; and individuals of the same species, as many of the Falcons, Gulls, Sandpipers, Ducks, &c., are so very dissimilar, and vary so greatly with age, change of season, and other circumstances, that colour cannot always be relied upon as affording sufficient evidence of specific identity. A much surer criterion will be found in the uniformity so conspicuous in the manners and economy of birds of the same kind; a coincidence which can only be accounted for by supposing that their actions are instinctive. That this is actually the case I shall attempt to show, though it must be admitted that they are occasionally modified, in a considerable degree, by the exercise of the intellectual faculties.

I will not occupy the time of the reader in examining the many vague and contradictory opinions which have been entertained with regard to the nature of instinct by the various authors who have written on the subject, being convinced that they are purely speculative, and tend to retard rather than advance the progress of science. We must not, however, pass unnoticed, the sophistical doctrine, so ingeniously maintained by Dr. Darwin, in *Zoonomia*,* that what is usually termed instinct in animals, has reference to the powers of intellect solely; since the feathered tribes, notwithstanding the highly curious and unequivocal examples of instinctive actions which they exhibit, have furnished him with some of his most plausible arguments in support of it.

Depending on the assertion of Kircher,† that young Nightingales, when hatched by other birds, never sing till they are instructed; and confiding in the remark of Jonston,‡ that the Nightingales which visit Scotland have not the same harmony as those of Italy; Dr. Darwin was hastily led to conclude, that the songs of birds, in general, are artificial. Having observed also, that Poultry readily

* See the *Section on Instinct*, Vol. 1.

† *De Musurgia. Cap. de Lusciniis.*

‡ Pennant's *British Zoology*.

obey their usual summons to be fed; and that young Ducks hatched under the Domestic Hen soon appear to understand her calls; and giving credit to the mistaken idea, that Wagtails and Hedge Warblers feed the young Cuckoos they bring up, long after they leave the nest, whenever they hear their cuckooing, which, on the authority of Linnæus,* he states to be their cry of hunger, he was induced to adopt the same opinion respecting their calls. Now, whether the song of the Nightingale results from education, as Kircher maintains, or whether it is wholly independent of tuition, I have never had any direct means of deciding, as the bird is only an accidental visitor in this part of the kingdom. From unexceptionable experiments, however, made with the greatest care, on several other species of British Singing Birds, I have no hesitation in affirming, that the peculiar song of each is the natural consequence of an instinctive impulse combined with a suitable state of the vocal organs. This latter condition deserves particular attention, for it is a fact,

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* *Systema Naturæ.*

which has been very generally overlooked, that most of our songsters are absolutely unable to continue their melodious strains beyond the latter end of July, or the beginning of August; the strenuous but unavailing exertions they make to prolong them, sufficiently proving their silence not to be a matter of choice, but of necessity. This circumstance, together with the extreme difficulty they experience in recommencing their songs in spring, clearly demonstrates, that their delightful warblings depend upon the energy of those muscles which contribute to form the voice; an energy which appears to be influenced chiefly by food, temperature, and the exercise of the reproductive functions; for by due attention to the regulation of those particulars, the vocal powers of caged birds may be called into action, or circumscribed at pleasure. Of this, persons who have the management of breeding Canaries may easily satisfy themselves; and female birds, in a state of captivity, when brought into high condition, are known, occasionally, to assume the song of the male. That Jonston must have been deceived in supposing he heard the Nightingale in Scotland is evident, as it is well known, that that Warbler is never found north of the Tweed, in Great Britain. It has been ascertained too, contrary to the opinion of Linnæus, that young Cuckoos, before they come to maturity, utter a feeble cry only; they cannot, therefore, acquire the calls of their species while they remain in this country. No wonder then, that the conclusion Dr. Darwin arrived at was erroneous, when the premises on which his reasoning is grounded are so inaccurate.

It is not, let me remark, intended to insinuate, that birds are incapable of attaining any knowledge of each others' notes; since our Domestic Fowls, in many instances, are certainly enabled, by observation and experience, to connect vocal sounds with the ideas they are designed to convey.* The House Martin also, readily learns to distinguish the Swallow's call of alarm; and the Ringed Plover, Sanderling, and Dunlin, when associated together, evince, by the

* When our Domestic Cock gives notice to his mates, that he has discovered some choice morsel of food, the Turkey hens always hasten to secure the delicacy, which the gallant Chanticleer suffers them to take, even out of his beak, without the least molestation.

promptitude and exactness with which they perform their various aërial evolutions, that they comprehend one general signal. All that is meant to be insisted upon is, that the notes peculiar to every species, in a state of nature, are instinctive. This I have endeavoured to prove, in an essay on the notes of birds, p. 30, by showing that even such individuals as are brought up in situations where they have no opportunity of being instructed in their appropriate notes, do, nevertheless, utter them naturally.

The pairing of wild birds, and the period at which they prepare to perpetuate their species, are determined, according to Dr. Darwin, by the acquired knowledge, that their joint labour is necessary to procure sustenance for a numerous progeny, and that the mild temperature of the atmosphere in spring is suitable for hatching their eggs, and for producing a plentiful supply of that nourishment which is wanted for their young. This opinion he attempts to support by the fact, that Poultry, which have an abundance of food throughout the year, and are protected from the inclemency of the weather, lay their eggs at any season and never pair.

But it should be recollected, that this is not the case with Pigeons placed under similar circumstances, which do pair, though they produce only two young ones at a time; and that the Pheasant among our naturalized, and the Black Grouse among our native birds, though they have both large families to provide for, are, in their wild state, polygamous. Indeed, it is evident from the anatomical and physiological researches of Mr. John Hunter and Dr. Jenner, that the sexual connexions of birds, and the season at which they breed, depend upon certain conditions of their organization, and not upon any information derived from experience or instruction.

The propensity to propagate their species, in this class of animals, is well known to be of periodical occurrence; and dissection clearly proves that it is always accompanied by a very perceptible alteration in the reproductive system. Besides, reclaimed birds, under the influence of a plentiful supply of nourishing food, shelter from the inclemency of the weather, and the various stimuli with which domestication is usually attended, may be kept in this state of sexual excitation for several years, with comparatively little interruption. A check to the greatly increased activity of the reproductive powers, so induced, is speedily given, however, by a diminution of sustenance and exposure to cold; at the same time also, a visible change takes place in the physical condition of the organs of reproduction.

In the selection of their mates, the feathered tribes are undoubtedly governed by instinct, as there is reason to believe that different species, in a state of nature, never pair together, however near their affinity, or general resemblance may be. The Rook is not observed to breed with the Crow, the Titlark with the Lesser Fieldlark, or Rocklark, the Sedge Warbler with the Reed Wren, or the Cole Titmouse with the Marsh Titmouse. Now, were every individual left to the unrestrained exercise of its own discretion in a matter of such essential importance, the utmost confusion might be expected to ensue; an unprolific, hybrid progeny would be speedily produced, and the total extinction of many species might be the ultimate consequence. But the allwise Author of nature has not suffered the reproduction of his creatures to be liable to such a contingency, but has implanted in the mind of each a powerful predisposition to form sexual unions with its own kind exclusively. Thus, the evils which would unavoidably result from the indiscriminate intercourse of various species are effectually prevented.

It must be admitted that an intermixture of distinct species does sometimes occur among our domesticated birds; but this deviation from their ordinary instinct is rare, and may, with great probability, be ascribed to a change in their organization, occasioned by the artificial mode of life to which they have been subjected. Now, as it is a maxim in physiology, that the exercise of every animal function is dependant upon its appropriate, material organ, any display of new instinctive phenomena, in birds which have long been under the controul of man, may also be attributed to the operation of the same physical cause. The singular propensity of the Cropper Pigeon to inflate its craw with air, and the still more remarkable disposition of the Tumbler to turn itself over backwards when on wing, which are permanent characters in those varieties of the Rock Dove, being transmitted by generation, can be satisfactorily accounted for on the foregoing supposition only. How unsafe it must always be to draw general conclusions from the habits and propensities of Domestic Fowls alone, whose instincts are frequently changed, almost as much as their plumage, by the unnatural state in which they are kept, needs scarcely to be insisted on.

Dr. Darwin conjectures, that birds learn how to build their nests from observing those in which they are educated, and from their knowledge of such things as are most agreeable to their touch in respect to warmth, cleanliness, and stability; but the undeniable fact, that birds, when taken very young, even before they can see, and brought up in confinement, do sometimes construct nests, is alone sufficient to refute this opinion.

The Sparrow Hawk and Kestril often make use of the deserted habitation of the Magpie as a receptacle for their eggs, and the Sparrow frequently takes forcible possession of the rustic dwelling of the House Martin for the same purpose. Why, then, are they never known to build nests similar to those which they thus appropriate to themselves? and why does not the Cuckoo, which is always brought up in the nest of some other bird, construct one itself?* The reason is obvious:—the act of nidification is not regulated by observation or instruction, but is under the immediate direction of instinct.

Guided by that mysterious power, individuals of the same species, under like circumstances, always adhere to the same stile of architecture. Thus, some of the smaller birds, which produce a large number of eggs, constantly make the entrance to their nests very narrow, and line the interior with an abundance of such materials as conduct heat slowly; while the Ring Dove, which lays two eggs only, forms so slight a structure, that they may frequently be seen through it. The Partridge, Land Rail, and those birds whose young are able to run almost as soon as they are hatched, generally give themselves very little trouble in providing nests for their progeny; and some species of Waterfowl do not make any, but deposit their eggs in the

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* I have pointed out the errors into which Dr. Darwin has fallen in his remarks on the Cuckoo, in my observations on that bird, p. 57.

crevices, and on the projecting shelves and ledges of lofty rocks, or upon the bare ground. The Sociable Grosbeak builds in society, under a common roof. The Pensile, Abyssinian, and Phillippine Grosbeaks construct curious nests, which they suspend from the slender twigs of trees, particularly such as grow over water; by this means securing their offspring from the predatory attacks of their numerous enemies; and the Tailor-bird frames its temporary abode by sewing two leaves together with the flexible fibres of plants, and lining the cavity with the lightest and softest animal or vegetable down.

It is true, that, in preparing their nests, birds occasionally accommodate themselves to some circumstances, and take advantage of others, in a manner which seems to indicate a large share of intelligence. The Wren, for example, usually adapts the exterior of its compact fabric to the situation in which it is placed. When built against a haystack, hay is almost invariably made use of, and green mosses, or withered leaves and fern are employed, as green or the various shades of brown prevail in its vicinity. Nor let it be imagined, that these substances, which, from their contiguity, are often most easily procured, are selected as a matter of convenience merely; for I have known this minute bird bring long pieces of straw from a considerable distance, with much toil, and, with incredible perseverance, mould the stubborn material to its purpose, solely because its colour approached that of a garden wall, a hole in which, occasioned by the giving way of a loose brick, it had chosen to place its nest in.

A lady, who keeps Canaries, was obliged to separate a young brood from their parents, having observed that the male bird stripped off the soft feathers from their necks and wings for the purpose of lining a newly constructed nest with them, notwithstanding a supply of old feathers had been put into the cage. From this remarkable fact, for which I am indebted to Dr. W. Henry, it is evident, that Canaries do not collect materials for their nests indiscriminately, but that they make a selection, in which they are directed by powers of a higher order than those of a merely instinctive character.

Mr. White, in his *Natural History of Sel-*

borne, page 59, informs us, that in Sussex, where there are very few towers and steeples, the Jackdaw builds annually under-ground, in deserted rabbit burrows. The same author remarks also, p. 175-6, that many Sand Martins nestle and breed in the scaffold-holes of the back-wall of William of Wykeham's stables, which stands in a very sequestered enclosure, facing a large and beautiful lake, near the town of Bishop's Waltham, in Hampshire; and some birds, as already represented, frequently spare their own labour by taking possession of the nests of others.

In these instances there certainly appears to be a great display of sagacity; yet there are facts which seem to render it doubtful whether the feathered tribes are capable of deriving much benefit from experience, or of exercising any remarkable degree of intelligence. Thus, birds, when engaged in the performance of their parental duties, expose themselves, without hesitation, to dangers, which, at another period, they would carefully avoid. Many species also, while under the incitement of appetite, are readily snared by the most simple contrivances, directly after witnessing the capture of their companions;

and Rooks continue to breed in those rookeries, where the greater part of their young is destroyed every spring.* For three successive seasons, a pair of Redstarts persisted in making their nest in the upper part of our pump, on that end of the lever which is connected with the rod of the piston, and, of course, always had it disturbed when that engine was used. Mr. White observes too,† that in the neighbourhood of Selborne, House Martins build, year by year, in the corners of the windows of a house without eaves, situated in an exposed district ; and as the corners of those windows are too shallow to protect the nests from injury, they are washed down every hard rain ; yet the birds drudge on to no purpose, from summer to summer, without changing their aspect or house.

These actions, it cannot be denied, seem to indicate a more limited degree of sagacity in birds than might be inferred from those immediately preceding them. This apparent contradiction, however, may be easily recon-

* I am assured by T. Legh, Esq., that many thousands of young Rooks are shot every breeding season in his extensive rookery, at Lyme Park, in Cheshire.

† *Natural History of Selborne*, p. 160.

ciled, by admitting, what, in all probability, will be thought sufficiently obvious, that the dictates of the understanding are frequently too feeble to resist the powerful influence of instinctive impulse. Several examples, illustrative of this view of the subject, will be found interspersed through the remainder of the essay. There is not any necessity, therefore, for entering into a more detailed consideration of it here.

After the business of nidification is completed, parturition commences, which is succeeded by incubation; and as birds will frequently continue to deposit their eggs in the same nest, though all, except one or two, should be removed as fast as they are laid, or exchanged for others of a different size and colour; and as they will sometimes, after having produced their appointed number, sit upon a single egg, on the eggs of other birds introduced for the purpose of experiment, on artificial ones of chalk, or even upon stones of any irregular figure; it is plain that the acts of depositing and incubating their eggs can be ascribed to instinct only. The parental offices of birds to their young are also regulated by instinctive feeling, as is evinced by their bestowing the same attention on the offspring of other species, when committed to their care, as they do upon their own. Thus, the Titlark and Hedge Warbler manifest the warmest attachment to the young Cuckoos, their foster nurslings, though they suffer their own progeny, ejected by the intruders, to perish from neglect within a short distance of the nest ; and this affection continues, with little diminution, till their supposititious offspring have nearly attained their full growth. Yet, under other circumstances, they would pursue and persecute them with the utmost rancour.

The instinctive nature of these actions is likewise satisfactorily established by the fact, that birds, when taken very young, and brought up in confinement, not only construct nests occasionally, but also lay their eggs in them, which they will sit upon till hatched, should they prove prolific, and will then carefully attend to the young. An anecdote or two, serving more fully to corroborate the opinion advanced above, will not, it is hoped, be unacceptable.

In the beginning of May, 1812, having found a Buzzard's nest containing a single egg, the egg was taken, and a light-coloured stone substituted for it, over which a rat-trap was set. The Buzzard sat upon the trap a day and night, when it was discovered, that the iron ring which confined the spring had not been withdrawn. The ring was then removed, and on visiting the nest afterwards, the female was found caught by the feet. This change of character, in so watchful and quicksighted a bird as the Buzzard, is certainly very surprising, and must baffle every attempt to connect it with any intellectual process.

A highly interesting anecdote, illustrative of the attachment of the Raven to its eggs, is thus admirably related by Mr. White.* "In the centre of a grove there stood an oak, which, though shapely and tall on the whole, bulged out into a large excrescence about the middle of the stem. On this a pair of Ravens had fixed their residence for such a series of years, that the oak was distinguished by the title of the Raven-tree. Many were the attempts of the neighbouring youths to get at this eyry: the difficulty whetted their

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* *Natural History of Selborne*, p. 6.

inclinations, and each was ambitious of surmounting the arduous task. But, when they arrived at the swelling, it jutted out so in their way, and was so far beyond their grasp, that the most daring lads were awed, and acknowledged the undertaking to be too hazardous. So the Ravens built on, nest upon nest, in perfect security, till the fatal day arrived in which the wood was to be levelled. It was in the month of February, when those birds usually sit. The saw was applied to the but, the wedges were inserted into the opening, the woods echoed to the heavy blows of the beetle or mallet, the tree nodded to its fall; but still the dam sat on. At last, when it gave way, the bird was flung from her nest; and though her parental affection deserved a better fate, was whipped down by the twigs, which brought her dead to the ground."

That ardent affection which most birds feel for their young seems to awaken their dormant energies, and to inspire them with a degree of courage and address that is called forth on no other occasion. Nor is the violence of this affection, to use the language of Mr. White, more wonderful than the shortness of its duration. Thus, every Hen is, in her turn, the virago of the yard, in proportion to the helplessness of her brood, and will fly in the face of a Dog or a Sow, in defence of those chickens which, in a few weeks, she will drive before her with relentless cruelty. The Partridge will tumble along before a sportsman, in order to draw away the Dogs from her helpless covey; and a very exact observer (the Rev. John White) has remarked, that a pair of Ravens, nesting in the rock of Gibraltar, would suffer no Vulture or Eagle to rest near their station, but would drive them from the hill with amazing fury; and that even the Blue Thrush, at the season of breeding, would dart out from the clefts of the rocks to chase away the Kestril or the Sparrow Hawk. Indeed, so regardless of danger are some species, while their nestlings are small, that I have known the Redbreast, Whinchat, Great Titmouse, &c., when introduced to their nests, after having been forcibly removed to a distance from their unfledged young, remain quietly upon them as if they had not been molested. Yet, although this instinct, the transient effects of which depend, most likely, on a temporary excitation of the parental feelings by some physical modification of the corporeal organs, thus, for a time, powerfully predominates, its manifestations are, nevertheless, frequently influenced by the active cooperation of the intellectual faculties, as in the following examples.

"The Flycatcher," says Mr. White,* "builds every year in the vines that grow on the walls of my house. A pair of these little birds had one year inadvertently placed their nest on a naked bough, perhaps in a shady time, not being aware of the inconvenience that followed. But a hot sunny season coming on, before the brood was half fledged, the reflection of the wall became insupportable, and must inevitably have destroyed the tender young, had not affection suggested an expedient, and prompted the parent birds to hover over the nest all the hotter hours, while with wings expanded, and mouths gaping for breath, they screened off the heat from their suffering offspring."

"A further instance," continues the same author,† "I once saw of notable sagacity in a Willow Wren, which had built in a bank in

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* *Natural History of Selborne,* p. 151.

† *Natural History of Selborne,* p. 151.

my fields. This bird, a friend and myself had observed as she sat in her nest; but were particularly careful not to disturb her, though we saw she eyed us with some degree of jealousy. Some days after, as we passed that way, we were desirous of remarking how this brood went on: but no nest could be found, till I happened to take up a large bundle of long, green moss, as it were, carelessly thrown over the nest, in order to dodge the eye of any impertinent intruder."

Actuated by a similar motive, old birds, which have had their young frequently handled, use every art to induce them to desert the nest as early as possible; and I have known the Redbreast, on such occasions, take off her nestlings, long before they could make the slightest use of their wings. That this mode of proceeding must be referred to intelligence, cannot, I think, be doubted, as the danger of allowing their progeny to remain in a state of insecurity is evidently perceived, and the surest means of avoiding it is deliberately adopted in consequence.

Many birds, under particular circumstances, manifest a natural inclination to fight. This disposition is remarkably conspicuous in the Ruff, the Quail, and the Domestic Cock. That the feeling is innate, and dependant upon organization, is clearly proved by the established fact, that careful breeding and training exercise a powerful influence upon the last species with regard to thispropensity.

Dr. Darwin states, that Pheasants and Partridges teach their young to select and take up their food; and hence he seems disposed to infer, that all birds receive instruction in those particulars; but that they are impelled by instinct, independently of education and experience, to exercise the functions of their various corporeal organs, whose structure is admirably adapted to the several offices they have to perform, admits of such numerous and decisive proofs, that it is truly amazing how a person of so much observation as Darwin could so entirely overlook them.

Those young birds which do not acquire the use of their eyes for several days after they are hatched, open their mouths for food as soon as they are stimulated by hunger, not only when the old ones bring it to them, but when anything approaches the nest. Nestlings too, as soon as they are grown sufficiently large, mute over the edge of the nest, though the parent birds carefully convey to a distance whatever drops from them that they do not succeed in ejecting. These actions occur also, when birds are brought up in confinement, however young they may be when taken, and, therefore, must be instinctive.

The Common Duck has its toes connected by a strong membrane, which enables it to swim with facility; and the young of that species, though hatched under birds which instinctively avoid committing themselves to the water, rush to it with avidity, almost as soon as they are extricated from the shell, notwithstanding the utmost exertions of the foster mother to divert them from it.

Young Swifts are rarely, if ever, observed to perch; and as they cannot easily be distinguished from old ones by their flight, they must display a considerable command of wing the very first time they quit the nest.

Many of the Gallinaceous tribe scratch up the earth with their feet, in search of food; and they will frequently repeat this action, when fed on a stone or boarded floor, where it can answer no useful purpose. Now, as they do not correct this error, it is plain, that the action itself does not originate in observation, experience, or reflection. Neither can it be attributed to education; nor is this particular misapplication of it to be ascribed to the force of habit, as it may often be observed in very young chickens, which have never associated with others of their kind. But, what is still more to the purpose, and, indeed, decisive of the general question, even Pheasants and Partridges, as well as Ducks, Chickens, Turkeys, and Guinea Fowls, which have been hatched by artificial heat, possess the instincts peculiar to their respective species, as I have had several opportunities of ascertaining. How young birds, by their struggles in the egg, can at all facilitate the use of their legs, as Dr. Darwin conjectures, is, to me, inconceivable, especially when the position in which they lie is taken into consideration. But, even supposing this notion to be correct, it does not, in the least, affect the instinctiveness of the act; unless we conclude, with Darwin, that instinct has nothing to do with any of those actions which result from the repeated efforts of the muscles under the conduct of the sensations or desires ; an opinion so manifestly erroneous that it does not require a formal refutation.

The habits and manners of birds are sometimes so greatly modified by the exercise of the intellectual faculties, that, in many cases, it becomes extremely difficult, if not impossible, to determine what is due to their influence ; but that no small portion of intelligence is exhibited in the following instances will scarcely be denied.

The White-headed Eagle, and several of the Gulls, which prey upon the finny inhabitants of the waters, frequently save themselves the trouble of fishing, by robbing their more expert and less powerful congeners of the fruits of their industry, occasionally compelling the objects of their violence, even to disgorge their undigested food.*

* John James Audubon, Esq., the celebrated author of the splendid work on *American Ornithology*, now publishing in London, informs me that when the White-headed Eagle pursues the Fish Hawk or Osprey, for the purpose of depriving it of its prey, it does not, in the first instance, attempt to rise above it, as stated by Wilson, in his *Ornithology of the United States of America*, vol. iv. p. 90-1, but, following it closely, urges it from below to as great an elevation as possible, in order that when the Hawk quits its prize, it may be able to secure the fish before it reaches the water. As the Fish

The Pied and Yellow Wagtails run close to the legs and noses of cattle which are grazing, in pursuit of the insects disturbed by them: the same motive also, induces these and many other birds to follow the husbandman when he is busy with the plough or harrow; and the Redbreast attends the gardener in his labours, and seizes the worms which he turns up with his spade.

Mr. White states,* that the Great Titmouse, in severe weather, frequents houses; and, in deep snows, as it hangs with its back downwards, draws straws lengthwise from the eaves of those buildings which are thatched, in order to pull out the flies that are concealed between them; and I have seen Hooded Crows, on the eastern coast of Ireland, after many unavailing efforts to break with their beaks some of the muscles on which they were feeding, fly with them to a great height in the air, and, by letting them fall on the stony beach, fracture their shells, and thus

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Hawks are not capable of contending individually with the White-headed Eagle, they sometimes combine together in considerable numbers to expel the marauder from their haunts.

* *Natural History of Selborne*, p. 106.

get possession of the contents. Perhaps it would not be easy to select a more striking example of intelligence among the feathered tribes than this, where, on one expedient proving unsuccessful, after a sufficient trial had been made of it, another was immediately resorted to.

Chickens, in their early attempts to catch flies and other winged insects, shew little or no address, but repeated failures teach them to use more circumspection; and they soon learn to distinguish between an active, vigilant prey, and the inanimate substances on which they likewise feed. This cautiousness of proceeding is clearly the effect of information obtained by experience, and affords an example of an instinctive power being excited to activity by the intellect; but a still more extraordinary instance of acquired knowledge is given by Montagu, in the Supplement to the *Ornithological Dictionary*. This gentleman observed two Crows, by the sea shore, employed in removing some small fish (the refuse of a fisherman's net) from the edge of the flowing tide. They carried them, one by one, just above high water mark, and there deposited them under large stones or broken fragments of rocks, after having amply satisfied the immediate calls of hunger. Now it must be conceded that these birds were aware that the advancing flood would sweep away their prize, unless they conveyed it beyond the limit of its usual rise, or their conduct is quite inexplicable. It is equally plain, that this knowledge, in the practical application of which they manifested so much foresight and sagacity, could be derived from observation and experience only; because, if it originated in a blind instinct, it would be common to every individual of the species, and consequently often displayed; whereas, although I have seen hundreds of Crows feeding in situations similar to that above described, I never perceived any of them resort to this effectual means of preserving their prey from the encroaching waters, and I believe the instance related by Montagu is solitary in the records of ornithology.

This propensity to hide the food it cannot devour is not, however, peculiar to the Crow. I have noticed it in the Raven and Magpie; and Rooks, in the autumn, frequently bury acorns in the earth, probably with the intention of having recourse to them when their wants are more urgent; but sometimes forgetting where they have concealed them, they germinate, and, not unfrequently, excite surprise by the singularity of the situations in which they grow, far distant from any trees by which they could have been produced, and where it is very evident that they have not been planted by man.

It may be proper to remark here, in order to obviate misapprehension, that notwithstanding the circumstances attending this seemingly provident mode of securing a supply of food against a future occasion, sometimes afford unequivocal evidence of an intelligent and discerning agent, yet the act of hiding is induced by a purely instinctive propensity. This will be admitted by every one who considers that the species of birds which are remarkable for this peculiarity practise it, however well they may be fed, when brought up from the nest in a state of domestication.

In addition to the numerous proofs of the intelligence of birds already given, I may mention their susceptibility of receiving instruction by education. Thus, Eagles, Falcons, and Hawks have been trained to limit the effects of their instinctive propensity to kill, to a particular species of game; and to return to the call and lure of the Falconer, after having struck down the quarry. The Cormorant, too, was formerly employed with success in taking fish. Here then, not only great attachment to their keepers, and much docility of disposition are evinced by birds which are naturally wild and voracious, but a considerable share of memory is displayed, and a surprising degree of controul exercised over some of their most active instincts.

Several birds of the Finch, Grosbeak, and Warbler genera acquire the art of piping long and difficult tunes with facility and precision; and it is well known that some of the Parrots, and also the Jay, Starling, Jackdaw, and Magpie readily learn to pronounce single words, and even short sentences, with tolerable exactness. Yet, although I have excellent opportunities of observing the last species, and have been almost in the daily practise of investigating its habits, I never knew it display any unusual exertion of its capacity for imitation in a state of nature, though, when domesticated, it appears to have this faculty more highly developed than almost any other British Bird.

The congregating of gregarious birds, which takes place in autumn, when they have finished breeding, is, perhaps, intended to promote their mutual security; as they are much less liable to be surprised by enemies when associated together in large numbers, than they are when separate. What tends to strengthen this opinion is the fact, that some species provide for the general safety, by appointing sentinels to give notice of approaching danger. This social disposition, which (with the well known exception of Rooks) usually continues no longer than the next pairing season, seems, from the uniformity of the actions that result from it, to be of instinctive origin; though it certainly would be difficult to bring any direct proof that such is the case.

In treating of the migration of birds, Dr. Darwin observes, that as all species are capable of remaining throughout the year in those countries in which they were bred, any departure from them must be unnecessary, and, therefore, cannot be instinctive. This reasoning, however, is extremely fallacious, inasmuch as it restricts the operations of instinct solely to what is necessary; whereas we have seen that the singing of birds, and the practice of concealing their superfluous food, though not absolutely indispensable, are, nevertheless, decidedly instinctive. It is, moreover, built on the gratuitous assumption, that several of the Periodical Summer Birds, as the Swallow, Flycatcher, Cuckoo, Goatsucker, &c., which feed almost entirely on insects, and, consequently, would not be able to procure a sufficient supply of nourishment in the winter months, have the property of passing the cold season in a state of torpidity; an hypothesis directly at variance with well established facts. Indeed, how very defective and unsatisfactory the arguments advanced in support of the hybernating system are, does not require insisting upon; as those who have considered the subject impartially must be well aware, that they are almost wholly founded on the hearsay reports of ignorant and credulous persons.

The history of the Cuckoo proves, most incontrovertibly, that the desire to migrate, in that species, is instinctive; since nearly all the young ones brought up annually in the north of Europe, quit it without receiving the least instruction that such a proceeding is requisite, and without any guide to direct them in their novel undertaking. But I forbear to dwell on the instincts of that extraordinary bird, partly on account of their being so very anomalous, but chiefly because I have considered them at length on a former occasion.* The highly curious fact, that the Swallow, House Martin, Sand Martin, and Puffin sometimes leave their last hatched broods to die of hunger in the nest, in order to accompany their species in their autumnal migration, is alone sufficient to establish the instinctiveness of that inclination which can thus overcome their parental affection, a feeling so energetic as frequently to counteract one of the most powerful laws of nature, self-preservation. No theory, in short, which is not founded on the opinion that birds of passage, in undertaking their annual journeys, are influenced by an instinctive desire to migrate, liable to be called into action by various exciting causes, can satisfactorily account for the remarkable phenomena which result from this periodical disposition to wander.

The certainty with which the Carrier Pigeon directs its course towards its accustomed

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* See observations on the Cuckoo, p. 57.

home, from distant places, where it has never been before, after every precaution has been taken in its conveyance to prevent it from obtaining any knowledge of the way by observation, must, as well as the act of migration, to which it bears a striking resemblance, be likewise attributed to instinct.*

It appears then, from the foregoing observations, that the principal actions of birds, though liable to be considerably modified by the operations of the intellectual powers and changes of organization, as well as by various external circumstances, are, contrary to the opinion of Dr. Darwin, decidedly of instinctive origin. Many additional arguments might be advanced, and a multitude of highly respectable authorities quoted in support of this doctrine; but conceiving that sufficient evidence has been already produced, I shall only add, that I am not aware of any serious objection which can be urged against it.

* Some birds, though not migratory, occasionally undertake long journeys, in which they cross extensive tracts of water. On the 16th of March, 1823, at noonday, my father saw, from the deck of the Vixen, steam packet, bound for Holyhead, being then near mid-channel, about thirty Rooks, winging their course towards the Irish coast; and, almost an hour after, five others were observed following in the same direction. The flight of these birds was low, silent, and direct; a steady breeze from the east was blowing at the time, and they passed within a short distance of the vessel.

OBSERVATIONS ON THE

PIED FLYCATCHER.

In directing the attention of ornithologists to a favourite haunt of the Pied Flycatcher, I am not without hope, that some individual, who has leisure for the undertaking, may be stimulated to investigate the manners and economy of this interesting species, with a greater degree of minuteness than has hitherto been done. The elucidation of several doubtful points in its history could not fail to reward his industry, and promote the interests of science.

On the 3rd of June, 1828, I procured a male Pied Flycatcher in the woods near the Ferry-house, on the western shore of Windermere, where I saw two males and a female. The female and one of the males had paired, and were occupied in constructing a nest in a hole in a decayed pollard ash, on the margin of the lake. But the vicinity of Ullswater appears to be the favourite resort of this species; as, in walking, on the 1st of June, from the water-head to Gowbarrow Old Park, on the western side of the lake, a distance not exceeding three miles, I saw, without quitting the carriage road, five males, at five separate stations, which were distinctly marked by large pollard ashes, partially decayed. To these spots the birds were evidently much attached, reluctantly retiring from them to a short distance when greatly disturbed, and immediately returning again when the cause of their alarm was removed. This circumstance led me to suppose that they had nests; and, as I did not observe a single female, it is probable that they were engaged in incubating their eggs, or in brooding their young. The males were all in full song, and their notes, which are sometimes, though rarely, delivered on the wing, are lively and pleasing.

Ornithologists do not seem to be acquainted with the extent of the vocal powers possessed by this species. According to Dr. Latham, (*General History of Birds*, vol. vi,) Mr. Bolton, the author of *Harmonia Ruralis*, has remarked, that the song of the male, which is heard in the breeding season, resembles that of the Spotted Flycatcher, but that it is more sprightly and energetic. The comparison is an unfortunate one, and may have induced a belief that the Pied Flycatcher has no song whatever, as the spotted species is one of our most silent birds. I am happy, therefore, in being able to claim for the Pied Flycatcher, a place among British Singing Birds.

Montagu and Latham have regarded the Pied Flycatcher as indigenous to England: several distinguished ornithologists, on the other hand, have considered it to be an occasional visitor merely: this latter opinion, however, must be abandoned, as it certainly breeds, year by year, in the woods, on the borders of Ullswater. The prevalence of the idea, that this species does not migrate, may be attributed, principally, to the assertion of Montagu, that it "rarely, if ever, makes its appearance in the southern parts of the island;" (see the *Supplement to the Ornithological Dictionary;*) but Messrs. Sheppard and Whitear, in their *Catalogue of the Norfolk and Suffolk Birds*, published in the

Transactions of the Linnean Society, vol. xv, part 1, state, that they have "seen a specimen of this bird which was killed near Cromer;" that "two others were caught by Mr. Downes in his garden at Gunton, in Suffolk; and a fourth was shot at Keswick, near Norwich." Mr. Selby, also, in his *Illustrations of British Ornithology*, informs us, that he has seen specimens from Dorsetshire; consequently, Montagu's observation loses much of its force: indeed, as the habits of this bird indicate that it preys chiefly on insects in their winged or perfect state, there can be little doubt that it is migratory; a sufficient reason, however, why the fact has not been more clearly ascertained, will be found in its great rarity and partial distribution. In Lancashire, I have never seen this species earlier in the year than April, nor later than September.

I have long known that the Pied Flycatcher breeds annually in the beautiful woods near Ullswater, but I was not aware, before the summer of 1828, that it is to be found in such abundance in that delightful locality. Subsequently, I have discovered that this species likewise breeds in Gwydir woods, near Llanrwst, in the vale of Conway, North Wales.

A BRIEF NOTICE OF

BEWICK'S SWAN.

FROM an examination of the various specimens of Swans contained in the Manchester Museum,—two of which are Whistling Swans or Hoopers, one in mature and the other in immature plumage, and a third is the *Cygnus Bewickii* of Mr. Yarrell, described in the *Transactions of the Linnean Society*, vol. XVI, p. 445 et seq.—I have, for several years past, strongly suspected that there are two distinct species of the genus *Cygnus*, which occasionally visit this country. But, notwithstanding the comparatively small size of the last-mentioned bird, its more clumsy figure, and the snowy whiteness of its plumage, which indicates maturity; in general appearance it bears so striking a resemblance to the Hooper, that I hesitated to announce it as a new species previously to having made myself acquainted, in some measure, with its habits and internal organization, no opportunity of investigating which had hitherto presented itself.

My attention has again been directed to this interesting subject, and my former suspicion corroborated, by a remarkable circumstance that lately occurred in the neighbourhood in which I reside. About half-past eight, on the morning of the 10th of December, 1829, a flock of twenty-nine Swans, mistaken, by many persons who saw them, for Wild Geese, was observed flying over the township of Crumpsall, at an elevation not exceeding fifty yards above the surface of the earth. They flew in a line, taking a northerly direction, and their loud calls, for they were very clamorous when on wing, might be heard to a considerable distance. I afterwards learned that they alighted on an extensive reservoir, near Middleton, belonging to Messrs. Burton and Sons, calico printers, where they were shot at; and an individual had one of its wings so severely injured that it was disabled from accompanying its companions in their retreat.

A short time since, I had an opportunity of seeing this bird, which resembled the rest of the flock with which it had been associated, and found, as I had anticipated, that it was precisely similar to the small Swan preserved in the Museum at Manchester, which, I should state, was purchased in the fish-market in that town, about five or six years ago.

Twenty-nine of these birds congregated together, without a single Whistling Swan among them, is a fact so decisive of the distinctness of this species, especially when taken in connexion with those external characters in which it differs from the Hooper, that I should no longer have deferred to describe it as a new bird to ornithologists, had I not been anticipated by Mr. Yarrell.

Of the habits and manners of this species little could be ascertained from a brief inspection of a wounded individual; I may remark, however, that, when on the water, it had somewhat the air and appearance of a Goose, being almost wholly devoid of that grace and majesty by which the Mute Swan is so advantageously distinguished. It appeared to be a shy and timid bird, and could only be approached near by stratagem, when it intimated its apprehension by uttering its call. It carefully avoided the society of a Mute Swan which was on the same piece of water.

On the 28th of February, 1830, at half-past ten A. M., seventy-three Swans, of the new species, were observed flying over Crumpsall in a south-easterly direction, at a considerable elevation. They flew abreast, forming an extensive line, like those seen on the 10th of December, 1829; like them, too, they were mistaken for Wild Geese by most persons who saw them with whom I had an opportunity of conversing on the subject; but their superior dimensions, the whiteness of their plumage, their black feet, easily distinguished as they passed overhead, and their reiterated calls, which first directed my attention to them, were so strikingly characteristic, that skilful ornithologists could not be deceived with regard to the genus to which they belonged.

That these birds were not Hoopers may be safely inferred from their great inferiority in point of size. Now the circumstance of the small Swans associating together in large numbers, unaccompanied by Hoopers, the only British species with which they could be confounded by naturalists, and the difference pointed out by Mr. Yarrell in their internal structure, are facts which completely establish their specific distinctness.

I am informed, that when the Wild Swans were shot at, near Middleton, on the 10th of December, 1829, one of them was so reluctant to abandon the bird which was wounded on that occasion, that it continued to fly about the spot for several hours after the rest of the flock had departed, and that, during the whole of this period, its mournful cry was heard almost incessantly. In consequence of the protracted disturbance caused by the persevering efforts of Messrs. Burtons' workmen to secure its unfortunate companion, it was at last, however, compelled to withdraw, and was not seen again till the 23d of March, when a Swan, supposed to be the same individual, made its appearance in the neighbourhood, flew several times round the reservoir in lofty circles, and ultimately descended to the wounded bird, with which, after a cordial greeting, it immediately paired. The newly arrived Swan, which proved to be a male bird, soon became accustomed to the presence of strangers; and, when I saw it, on the 4th of April, was even more familiar than its captive mate. As these birds were strongly attached to each other, and seemed to be perfectly reconciled to their situation, which, in many respects, was an exceedingly favourable one, there was every reason to believe that a brood would be obtained from them. This expectation, however, was not destined to be realized. On the 13th of April, the male Swan, alarmed by some strange dogs which found their way to the reservoir, took flight and did not return; and on the 5th of September, in the same year, the female bird, whose injured wing had recovered its original vigour, quitted the scene of its misfortunes and was seen no more.

ON A REMARKABLE

FORMATION OF THE BILL

OBSERVED IN SEVERAL SPECIES OF BIRDS.

INSTANCES of extraordinary deviation from typical forms in the structure of animated beings are highly interesting to the physiologist, whether his attention be directed to the influence which organic modifications exercise upon the animal economy, or to the more abstruse investigation of the predisposing causes of these curious phenomena. Such being the case, a concise account of a few examples of this nature, which have recently come to my knowledge, will, it is presumed, require no apology.

A Jackdaw, killed at Bowers, in the parish of Standon, Staffordshire, was presented, in January, 1830, to the Society for the Promotion of Natural History, established in Manchester; and is now deposited in their Museum. This bird, in the structure of its bill, presents a form closely resembling that which so strikingly characterizes the species constituting the genus *Loxia*, the mandibles crossing each other at some distance from their points, the upper one curving downward on the right side of the lower one, which takes an upward direction to the left. The preternatural elongation of the mandibles, in conjunction with a considerable degree of curvature, gives to this individual, which, on dissection, proved to be a male, a peculiar physiognomical expression, and must have contributed greatly to modify its manner of feeding; the contents of the stomach, however, were so changed by maceration, that it was not possible to determine by inspection of what they consisted. I may remark, that this bird was in excellent condition, notwithstanding the inclemency of the season; a convincing proof that it had acquired much expertness in the management of its singularly formed bill.

A Rook, also preserved in the Manchester Museum, has its mandibles crossed near their extremities, but so slightly as not to have interfered materially with the mode of procuring food usually employed by that species, as is clearly evinced by the denuded state of the nostrils and the anterior part of the head, both of which are entirely destitute of feathers. Another specimen, in the possession of Mr. R. Wood, a zealous collector of objects in natural history, residing in Manchester, has the mandibles greatly elongated and much curved, as in the case of the Jackdaw, detailed above. Now it is evident that the bird, possessing a bill thus formed, could not thrust it into the ground in search of worms and the larvæ of insects, as the Rook is known to do habitually; and, accordingly, the plumage at the base of the bill of this individual, and the bristly feathers which cover its nostrils, are very conspicuous; not having sustained the slightest injury. The opinion, entertained by many persons, that the naked condition of the nostrils and anterior part of the head is an original peculiarity in the Rook, is thus satisfactorily proved to be incorrect: indeed, the fact, that young Rooks exhibit no deficiency in these particulars, is sufficiently conclusive on this point; but the possibility of an entire species being endowed with an instinct destructive of a useful portion of its organization was probably never contemplated by these observers; it is not surprising, therefore, that the inference, deduced from a partial view of the subject, should be erroneous.

The last instance of this anomalous structure of the bill, which has fallen under my observation, occurred in a specimen of the Red-headed Woodpecker (*Picus erythrocephalus*, Linn.) contained in a collection of birds' skins lately brought from the United States of North America. In this individual, the mandibles, though pretty much elongated, are but slightly curved; the upper one, as in the preceding cases, (Mr. Wood's Rook alone excepted, in which the direction is reversed,) crossing the lower one on the right side. A bill so constructed must have proved exceedingly inconvenient to a bird of this species.

I might now proceed to speculate upon the circumstances which have contributed to produce this phenomenon; but as my acquaintance with the history of the birds in which I have seen it exhibited is so imperfect, that any thing I could advance concerning them would be little more than conjectural, I shall decline entering into the inquiry.

REMARKS ON THE

DIVING OF AQUATIC BIRDS.

"THE superior velocity with which Aquatic Birds swim under water has not wholly escaped notice; but it is not entirely produced by the action of the wings, which are sometimes used as fins to accelerate the motion, but is occasioned by the pressure of the water above. In swimming on the surface a bird has two motions; one upwards, the other forward, at every stroke of the feet; so that, when covered with water, that force which was lost by the upward motion is all directed to the progressive, by which it is enabled to pursue its prey or to escape an enemy with incredible speed."

Many years since, when perusing, for the first time, the foregoing observations on the diving of Water-fowl, contained in the Introduction to Montagu's *Ornithological Dictionary*, p. xxxix-xl, the insufficiency of the author's attempt to solve this problem in natural history was perceived, and I was induced to make a few comments on the subject in my zoological note-book: it is probable, however, that they never would have filled a more conspicuous situation than that which they have so long occupied in its pages, had not my attention been again directed to them by Dr. Drummond's recent introduction of Montagu's hypothesis, which is directly opposed to the established principles of dynamics, in his interesting *Letters to a Young Naturalist*.

It is asserted by the advocates of this hypothesis, that the action of the legs in diving, not only gives to birds a progressive motion, but also a tendency to rise; which tendency being overcome by the pressure of the water above them, the entire moving force is directed in the line of the body, accelerating thereby the velocity with which they pursue their subaqueous course.

Now it is a law of hydrostatics, that the pressure of fluids, in a state of equilibrium, is equal in all directions at the same depth; whatever obstacle, therefore, the circumstance of pressure may present to the ascent of a bird, when diving, it must also present, *cœteris paribus*, to its progressive motion.

Moreover, it is manifest, from the exceeding facility with which the particles of water move among one another, that if any tendency upwards did result from the action of the limbs of Water-fowl in diving, it could not be wholly counteracted by the pressure of the mass of fluid above them: indeed, the specific gravity of such birds being less than that of water, it would not be possible for them to continue beneath its surface, even for a much shorter period than they are known to do, without the employment of physical force to effect their purpose; hence, the fallaciousness of the argument, that the propelling power is increased on such occasions by the pressure of the superincumbent water, is rendered sufficiently obvious.

It remains to consider what means are actually made use of by birds in diving to overcome the resistance of the medium in which they move, and the tendency upwards arising from their small specific gravity; and as Mr. White has illustrated this subject in his usual felicitous manner, in treating upon the Northern Diver, *Colymbus glacialis*, Linn., in the second volume of the octavo edition of his *Works in Natural History*, p. 184-6, I cannot do better than avail myself of his observations.

"Every part and proportion of this bird (the Northern Diver) is so incomparably adapted to its mode of life, that in no instance do we see the wisdom of God in the creation to more advantage. The head is sharp and smaller than the part of the neck adjoining, in order that it may pierce the water; the wings are placed forward and out of the centre of gravity for a purpose which shall be noticed hereafter; the thighs quite at the podex, in order to facilitate diving; and the legs are flat, and as sharp backwards almost as the edge of a knife, that in striking they may easily cut the water; while the feet are palmated, and broad for swimming, yet so folded up when advanced forward to take a fresh stroke, as to be full as narrow as the shank. The two exterior toes of the feet are longest; the nails flat and broad, resembling the human, which give strength and increase the power of swimming. The foot, when expanded, is not at right angles to the leg or body of the bird: but the exterior part inclining towards the head forms an acute angle with the body; the intention being not to give motion in the line of the legs themselves, but, by the combined impulse of both, in an intermediate line, the line of the body.

"Most people know, that have observed at all, that the swimming of birds is nothing more than a walking in the water, where one foot succeeds the other as on the land; yet no one, as far as I am aware, has remarked that Diving Fowls, while under water, impel and row themselves forward by a motion of their wings, as well as by the impulse of their feet: but such is really the case, as any person may easily be convinced who will observe Ducks when hunted by dogs in a clear pond. Nor do I know that any one has given a reason why the wings of Diving Fowls are placed so forward: doubtless, not for the purpose of promoting their speed in flying, since that position certainly impedes it; but probably for the increase of their motion under water, by the use of four oars instead of two; yet were the wings and feet nearer together, as in Land-birds, they would, when in action, rather hinder than assist one another."

Mr. White's description of the manner in which the Northern Diver impels itself through the water by the agency of the legs, which have an extent of motion enabling it to alter its course, in any direction whatever, with astonishing facility, is applicable to Diving Birds in general; but it does not appear that the wings are so uniformly employed to promote their progress, when submerged, as the statement of the natural historian of Selborne would seem to imply.

I may remark, in conclusion, that the action of the legs in diving, so far from giving birds an impulse *upwards* and forwards, as Montagu has affirmed, evidently tends rather to propel them *downwards* and forwards, except when they purpose to ascend, and then a change of action, adapted to the accomplishment of the object to be attained, is instantly resorted to. The simultaneous action of the legs also, directing the impelling power in the line of the body, will explain why the velocity with which Aquatic Birds move in so dense a fluid as water is greater than that with which they move on its surface, where the legs are usually employed alternately, and the moving force cannot be so advantageously applied; and that the velocity is frequently accelerated still further, by the instrumentality of the wings, has been already noticed.

Thus, in controverting the erroneous opinions of Montagu relative to the diving of Water-fowl, I have endeavoured to substitute for them an unobjectionable theory of this remarkable phenomenon.

SOME ACCOUNT OF THE MANNERS

OF THE

GRENADIER GROSBEAK,

Loxia Oryx, Linn.,

WHEN IN CAPTIVITY.

THERE is no disputing that an intimate acquaintance with the economy of the feathered tribes is absolutely essential to the arrangement of species according to their relations of affinity and analogy, or, in other words, in strict conformity with the system of nature; yet, important as this knowledge is admitted to be, perhaps it is not going too far to assert, that scarcely any department of ornithology is more defective than that in which this interesting subject is treated upon. The investigation of the manners of birds, in their native haunts, is undoubtedly attended with numerous difficulties, and, as regards foreign species, is frequently impracticable. These circumstances may certainly be alleged in palliation of any charge of negligence on the part of ornithologists implied in the above remarks, but still only in palliation, for that much may be effected by individual exertion, the labours of Le Vaillant, White, Wilson, Audubon, &c., bear abundant testimony.*

These animadversions have been suggested by a recent visit to the aviary of Mr. Garside, at his residence, in Piccadilly, Manchester; where, among various objects of attraction to the bird-fancier, such as piping Bullfinches, loquacious Starlings, and superb Parrakeets, which displayed powers of imitation as astonishing as they were entertaining, I noticed several choice exotic birds, whose habits and notes afforded me much gratification. A fine male Grenadier Grosbeak, in particular, engaged my attention; I say a male, although it had not the black plumage on the throat which Dr. Latham

* The obligations I am under to my literary and scientific friends in general, and to Dr. Holme, of Manchester, and the Rev. J. Clowes, of Broughton Hall, in particular, for opportunities which they have afforded me of consulting scarce and valuable works on natural history, demand my warmest acknowledgments.

seems disposed to regard as a characteristic of that sex; for Barrow, in his *Travels into the Interior of Southern Africa*, vol. I. p. 243, distinctly states, that "the male is remarkable for its gaudy plumage during the spring and summer months;" and again, "during the other six months it is stripped of its gaudy attire, and adopts the modest garb of the female, which is at all times that of a greyish brown." Now the economy of the individual under consideration is confirmatory of the correctness of Barrow's observations, as I am informed by Mr. Garside, that it changes its feathers twice in the course of the year; the first moult occurring about May, when it acquires the splendid livery of the pairing season, and the second in November, at which period its gay wedding dress is laid aside for a homely suit of brown of various shades. In short, so complete is the metamorphosis, (the bill itself undergoing a change of colour,) that its specific identity would be called in question by any person unacquainted with these particulars in its history. It is probable, therefore, that the black plumage on the throat may indicate maturity, or it may conveniently be ascribed to the influence of circumstances which in our ignorance we term accidental.

Another fact, tending to corroborate the opinion that this bird is a male, deserves consideration : it has a song, and a most extraordinary one it is. Elevating the brilliant red feathers on the back of its neck, and raising itself on its perch till it assumes an attitude so perpendicular that it appears to be in danger of falling backwards, it commences its lay by uttering one or two sharp chirps, which are followed by a chattering sound produced by the hurried repetition of the same note; to this succeeds a sort of snapping noise, similar to that occasioned by bringing the open mandibles into sudden contact, and the *finale* consists of a protracted sound, enforced with considerable emphasis at regular intervals, somewhat resembling the sibilation which results from the grinding of scissors. Mr. Audubon, the celebrated American ornithologist, who saw this bird when he was last in Manchester, compared the concluding part of its song to the sound produced by the brisk agitation of the tail of the Rattlesnake. While pouring forth its discordant strains, this grotesque vocalist frequently raises its wings, expands them in a slight degree, and again brings them into their ordinary position of repose. It also approaches slowly towards any of its companions in captivity which happen to occupy the same perch with itself, and endeavours to touch them with its bill, as if it were desirous to elicit their attention in particular to its strange music; which, in conjunction with its fierce deportment, has usually the effect of exciting consternation in that portion of its audience.

For the purpose of calling into action one of the most singular instincts with which this bird is endowed, Mr. Garside supplied it with a little thread. No sooner had it obtained the prize than a Dominican Grosbeak, *Loxia Dominicana*, Linn., hastened to dispute its right of possession. Erecting the feathers on the back of its neck, and uttering a few angry chirps, the Grenadier Grosbeak threw itself into one of its most menacing attitudes, in order to intimidate the insolent aggressor; but, notwithstanding all these formidable indications of resistance, it was compelled to yield the object of contention to its more powerful adversary, which, after carrying it about the cage for a short time, became tired of the amusement and suffered it to drop, when it was instantly seized by the vigilant Grenadier Grosbeak. This was the signal for a renewal of hostilities, and several species of *Fringillæ* and *Loxiæ* joined eagerly in the affray; while a few grave looking birds, belonging to the genera *Palæornis*, *Platycercus*, and *Psittacula*, sat on the upper perches, passive spectators of the turbulent scene below. At length, by dint of perseverance, the Grenadier Grosbeak again succeeded in gaining possession of the thread, one extremity of which it immediately proceeded to attach to the wires of the cage. After accomplishing its object by the employment of the bill alone, it passed the other end of the thread through one of the intervals between the wires, directing it towards the adjoining interval on the right; then quitting hold of it, and inserting its bill into the latter interval, it again seized the thread near its extremity, drew it through the opening, and pulled it tight. In this manner it interwove the whole of the thread among the wires of the cage, with a quickness and dexterity quite surprising, and so delighted was the feathered operative with this engrossing occupation, that it repeatedly demolished its work and renewed it again, varying the direction it gave to the thread as the circumstances of the case seemed to require, the principal object in view, apparently, being the production of a compact tissue. If supplied with a sufficient quantity of thread, Mr. Garside assured me that this industrious bird would speedily cover the sides of the cage with its ingenious work, and so indefatigable is it in procuring materials for the prosecution of its labours, which are not restricted to any particular season of the year, but are pursued, even in winter, when it has assumed the garb of the female, that Mr. Garside has been under the necessity of removing a beautiful male Whidah Bird, *Vidua paradisœa*, Cuvier, into another cage, in order to preserve the long feathers of its tail from the injuries to which they were liable in consequence of the incessant efforts of the Grenadier Grosbeak to appropriate them to its purpose. When about to be attacked by another bird, the Grenadier

Grosbeak sometimes interlaces the anterior toes of one of its feet with the thread, the better to secure it; by which contrivance its bill is left at liberty to repel the marauder.

Nothing satisfactory appears to be known concerning the nidification of this species of Grosbeak. If, as Dr. Latham conjectures, (*Gen. Hist. of Birds*, vol. v, p. 223,) it is identical with Kolben's Finch, it constructs a nest of small twigs, closely interwoven with cotton, and so compact as not to be penetrated by the weather; but I am not aware that these birds have been ascertained to be specifically the same. The only information relative to this subject given us by Barrow is, that the Grenadier Grosbeaks are gregarious, and build their nests in large societies. (*Travels into the Interior of Southern Africa*, vol. I, p. 243.) It may be safely inferred, however, from what has already been stated with regard to the instinctive propensities manifested by this species, when in confinement, that it is, strictly speaking, a Weaver Bird; and this opinion being supported by the general character of its external structure also, I have no hesitation in removing it from among the heterogeneous forms with which it is associated in the Linnean genus *Loxia*, into a more appropriate situation, namely, the genus *Ploceus* of M. Cuvier, still retaining its original specific appellation.

That the true place of a bird in the system of nature may sometimes be ascertained by an attentive observation of its manners in a state of captivity, I have attempted to show in the case of *Ploceus Oryx*, just detailed; and, I trust, with sufficient success to induce those persons, whose opportunities of pursuing similar investigations are superior to my own, to exert themselves in promoting the elucidation of this important branch of ornithology.

DESCRIPTION OF A

NEW SPECIES OF FALCO.

Order........*Raptores*.....Illiger.
Family.......*Falconidæ*....Leach.
Sub-family....*Falconina*.... Vigors.
Genus........*Falco*........ Linnæus.
Falco Auduboni.

THE bill, which is curved from the base, is of a deep blue colour, approaching to black at the tip; the upper mandible is provided with a prominent tooth on each side, a corresponding notch occurring on the under mandible, which is truncated at the extremity. The colour of the cere is yellow. The nostrils are circular, with a tubercle in the centre. The upper part of the head and neck are blackish brown, with a slight tinge of blue; the cheeks, and a line above each eye, are yellowish white, marked with fine, longitudinal streaks of dark brown. On the back of the neck is an obscure collar of yellowish white, spotted with dark brown. The back, scapulars, tertials, and upper tail-coverts are greyish black, tinged with blue, each feather having a narrow, black line down the middle. The upper wing-coverts are brownish black, faintly tinged with blue. Quill feathers of the wings brownish black, the inner webs being marked with numerous, oval, white spots. The first and second primary quills have their inner webs deeply and abruptly emarginated near their extremities; the second and third, which are the longest, are nearly of an equal length. Tips of the primaries (the first three excepted) and of the secondaries, finely bordered with dull white. The tail is brownish black, tipped with white, and has several narrow, transverse bands of a cinereous hue. The chin and throat are white, streaked longitudinally with fine lines of dark brown. Breast, sides, abdomen, and under tail-coverts, yellowish white, with longitudinal streaks, and spots of a dark brown colour; the largest and roundest spots occur on the sides. Under wing-coverts dark brown, spotted with white.

The feathers of the legs extend a little below the knee; those of the thighs are pale ferruginous, streaked longitudinally with dark brown. The tarsi and toes are yellow; the former being reticulated, and the latter scutellated above. Claws black. Colour of the eyes not known.

Length, from the point of the bill to the extremity of the tail, $9\frac{4}{5}$ inches; wings, from the carpal joint to the tip of the second quill feather, $7\frac{1}{2}$; tail 5; bill, from the point of the upper mandible to the rictus, $\frac{7}{10}$; tarsi $1\frac{3}{10}$; middle toe, including the claw, $1\frac{3}{5}$.

The Museum belonging to the Society for the promotion of Natural History, established in Manchester, contains the small Falcon described above, which is probably a male. It was sent to this country from Philadelphia, in a collection of the skins of birds of the United States of North America; and, as it does not appear to have been previously characterized, it is possible that it may have been confounded by ornithologists with the Pigeon Hawk, *Falco columbarius*, Linn., and with other minute, nearly allied species. It has the closest affinity with the Merlin, but may readily be distinguished from that bird by its smaller size; by the tips of the folded wings approaching nearer to the end of the tail; by the plumage of the upper parts, which is much darker coloured, resembling that of the Hobby; and also by the plumage of the inferior parts, which has less of the ferruginous tint.

A skin, which I obtained from the same collection, appears to have belonged to an immature male of this Falcon. It differs from that of the adult male, principally in having the plumage of the upper parts of a deep brown colour, (with the exception of a few feathers which have assumed the dark bluish tint,) and in the oval spots on the inner webs of the quill feathers of the wings having a pale red-brown hue.

I have dedicated this species to J. J. Audubon, Esq., the celebrated author of the *Ornithological Biography;* whose splendid illustrations of the *Birds of America*, to use the words of the illustrious Cuvier, constitute the most magnificent monument which has hitherto been raised to ornithology.

DESCRIPTION OF A NEW SPECIES OF

LAMPROTORNIS.

THERE are deposited, in the Manchester Museum, two specimens of a bird belonging to the genus *Lamprotornis*, which, notwithstanding it is one of the most superb species of its tribe yet discovered, has escaped the notice of ornithologists. The following brief description will serve to convey some idea, though it must be admitted an inadequate one, of this highly interesting and beautiful bird.

Order........ *Insessores* ...... Vigors.
Tribe........ *Conirostres* .... Cuvier.
Family ...... *Sturnidæ* ...... Vigors.
Sub-family .. *Lamprotornina*.. Stephens.
Genus ...... *Lamprotornis*... Temminck.
Lamprotornis Vigorsii.

The bill and legs are black. The plumage is soft, silky, and glossy. The upper part of the head, sides and back of the neck, anterior region of the back, and lesser wing-coverts, are of a burnished golden green colour; a narrow border of fine purple separates the anterior from the posterior part of the back, and from the scapulars, both of which are of a rich golden bronze; greater wing-coverts and feathers of the spurious wings deep purple, relieved with violet-blue and gold; the exterior webs of the quill feathers of the wings are of a brilliant golden bronze; those of the primaries, and the tips and inner webs of the tertials having a mixture of purple and violet-blue; the tips of the primaries are purple, glossed with violet-blue and green, and the exterior and inner webs of several of the larger quills in each wing are abruptly emarginated, the latter near their termination, a prominent point, formed by the projection of the more elongated fibres of the webs, rendering the sudden transition in their breadth remarkably conspicuous; inner webs of the primaries and secondaries obscure purple, reflecting a faint golden lustre in a powerful light. Tail rounded at its extremity, black, with a slight mixture of golden bronze above, particularly on the middle feathers; tip and outer edges of the lateral feathers purple, resplendent with violet-blue and green; upper and under tail-coverts purple, varied with violet, steel-blue, and green; cheeks purple, tinged with green; throat and anterior part of the neck and breast similar in colour to the scapulars, but less brilliant; abdomen green bronze, tinged with gold; thighs and flanks purple, blended with violet, gold, and steel-blue; under side of the wings and tail black. Colour of the eyes not known. The tints of the plumage vary considerably in intensity in different specimens.

Length, from the apex of the bill to the extremity of the tail, $11\frac{2}{5}$ inches; wings, from the carpal joint to the tip of the fourth quill feather, $6\frac{1}{10}$; tail $4\frac{7}{10}$; bill, from the apex to the forehead, $\frac{9}{10}$; to the rictus, $1\frac{2}{5}$; tarsi $1\frac{7}{20}$; middle toe, including the claw, $1\frac{1}{5}$; hind toe, including the claw, $\frac{19}{20}$.

As the two individuals of the above species, in the Manchester Museum, were imported to Liverpool from Brazil, along with a considerable collection of the skins of Brazilian birds, it is possible that this elegant creature may be a native of South

America. I have no positive information, however, that such is the fact; and M. Temminck, in treating upon the group to which it belongs, (see his *Manuel d' Ornithologie*, vol. I, p. lv, note (3,) remarks, that "toutes les espèces sont de l'ancien continent, le plus grand nombre d' Afrique."

I have named this splendid bird in compliment to that distinguished and disinterested naturalist N. A. Vigors, Esq., who politely directed my attention to it as a species new to ornithologists.

In detailing those peculiarities of structure which characterize the genus *Lamprotornis*, M. Temminck says of the toes "l'interne soudé à sa base, l'externe divisé," (*Manuel d' Ornithologie*, vol. I, p. lvi,) the very reverse of what is actually the case. This error, which probably originated in inadvertency, has been recently repeated by an eminent French zoologist; it becomes the more desirable, therefore, that it should be corrected.

DESCRIPTION OF A

NEW SPECIES OF CREX.

In the present advanced state of our knowledge of the ornithology of North America, any addition to the birds comprised in the published Fauna of that country must be regarded with considerable interest. The minute Crake, of which I am about to give a description, not only possesses this claim to the attention of naturalists, but also the superior recommendation of being new to science; at least all my endeavours to identify it with any species recorded in those works on ornithology to which I have access have hitherto proved unavailing.

Order.... *Grallatores*.... Illiger.
Family... *Rallidæ* ...... Leach.
Genus....*Crex* .... Bechstein.
Crex pygmæa.

The bill is black; the upper part of the head and the back of the neck are black, with a slight tinge of a deep olive colour; the anterior portion of the back is plain olive-brown; the lower part of the back, the scapulars, and upper tail-coverts being olivaceous black, thickly spotted with white; the upper wing-coverts are blackish brown, marked with numerous white spots. Quill feathers of the wings blackish brown; the first having a row of small, white spots on its outer web; the tertials are conspicuously spotted with white, and the flexure of the wings is yellowish white. The chin and throat are of a pale cinereous hue; sides of the head and neck, breast, and the anterior part of the abdomen, of a deep ashy lead colour; lower part of the abdomen cinereous black, transversely banded with white; tail and under tail-coverts deep olivaceous black, the latter dashed with yellowish white. The legs are pale brown.

Length, from the point of the bill to the extremity of the tail, $4\frac{7}{20}$ inches; to the extremity of the middle toe, 6; wings, from the carpal joint to the tip of the third quill feather, $2\frac{3}{4}$; tail $1\frac{7}{20}$; bill, from the point to the rictus, $\frac{3}{5}$; tarsi $\frac{3}{4}$; middle toe, including the claw, $\frac{9}{10}$; hind toe, including the claw, $\frac{3}{10}$; tibiæ bare of feathers above the knee $\frac{1}{4}$.

This *unique* specimen, which originally belonged to Mr. R. Wood, of Manchester, but is now in my possession, was sent to this country from Philadelphia, in an extensive collection of the skins of birds indigenous to the United States of North America.

A REMARKABLE

PHYSIOLOGICAL FACT.

A Spaniel bitch, belonging to Mr. Robert Scholes, of Cheetham Hill, near Manchester, in the autumn of the year 1830, brought up a kitten, and a fawn of the Fallow Deer; which she attended to as assiduously as if they had been her own offspring. Instances of animals, when deprived of their young, attaching themselves to the progeny of other species, endowed with physical and mental powers differing widely from their own, are of frequent occurrence; and the warmth of affection, usually manifested towards the nurslings on such occasions, proves how deeply the parental feelings are implanted in the inferior orders of animated beings. I have known the Domestic Cat, for example, take charge of young Squirrels, and young Hares, which, but for the powerful influence of this active principle, would, in all probability, have fallen victims to feline voracity. But what renders the case before us peculiarly interesting to the physiologist is the fact, that the bitch, which was only about fourteen months old, had never had whelps; it is reasonable to suppose, therefore, that the secretion of milk in her teats was promoted by the excitation induced by the repeated efforts of the kitten and fawn to derive sustenance from that source. The fawn increased in growth so rapidly that it soon greatly exceeded its foster mother in stature.

ON THE

INJURY

DONE TO THE

FOLIAGE OF THE OAKS,

IN THE NEIGHBOURHOOD OF MANCHESTER,

IN THE SPRING OF 1827.

INSECTS, though diminutive in size, and insignificant in appearance, when associated together in large numbers, frequently become exceedingly formidable and destructive. A striking illustration of this fact is supplied by the appalling devastation which is sometimes occasioned by extensive bodies of Locusts; a circumstance thus emphatically described in the bold, figurative language of the prophet Joel, ii. 2—6. "A day of darkness and of gloominess; a day of clouds and of thick darkness; as the morning spread upon the mountains: a great people and a strong; there hath not been ever the like, neither shall be any more after it, even to the years of many generations. A fire devoureth before them; and behind them a flame burneth: the land is as the garden of Eden before them; and behind them a desolate wilderness; yea, and nothing shall escape them. The appearance of them is as the appearance of horses; and as horsemen, so shall they run. Like the noise of chariots, on the tops of mountains, shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle-array. Before their face the people shall be much pained: all faces shall gather blackness." From this dreadful scourge, and from other plagues of a similar though less distressing character, the inhabitants of the British Isles are, fortunately, in a great measure, exempt. Still they do, occasionally, experience much inconvenience, both as regards their persons and property, from noxious animals of this class. A multitude of examples, confirming the truth of this remark, might easily be adduced; but as lengthy details, relative to a matter of such general notoriety, would, in all probability, be deemed superfluous, I shall, in the present instance, limit my observations to a case of recent occurrence; in which the oaks in the vicinity of Manchester were nearly stripped of their foliage by two minute species of insects.

Early in May, 1827, the Green Weevil, *Curculio argentatus*, appeared in unusual numbers in this neighbourhood; and by its extensive ravages greatly disfigured many of our most ornamental trees and shrubs; the copper-beech, in particular, in some situations, suffered severely. Towards the termination of the month, this indiscriminate feeder attacked the young leaves of the oak, which were then expanding, and the effects of its depredations soon became very conspicuous in the gnawed and withered foliage.

To this pest quickly succeeded another, the larva of a small moth, *Tortrix viridana*, which completed the devastation commenced by the Green Weevil; and the monarch of the grove, nearly destitute of verdure, and loathsome with numerous caterpillars, stood almost leafless, wearing a wintry aspect even in the middle of June. These caterpillars, in common with many others provided with an apparatus for spinning, on being disturbed, hastily quit their retreats among the convoluted leaves, and descend towards the earth by a fine line, formed of a viscous secretion, which hardens on exposure to the atmosphere. So extremely abundant were they at the period alluded to, that, during a brisk wind, thousands might be seen thus suspended; some, carried out by the breeze far beyond the widest spreading branches of the tree to which their threads were attached; others, with violent contortions, slowly ascending their silken filaments; and all, as they were wafted to and fro, fantastically dancing in the agitated air, without any visible support; their lines being too attenuated to be discerned by the unassisted eye, except when they occasionally reflected, with a silvery lustre, the vivid light of the unclouded sun. The spectacle, as may be supposed, was at once highly singular and interesting.

During the continuation of these insects in the larva state, various species of the feathered tribes feasted upon them luxuriously. The Wood Wren, Yellow Wren, Whitethroat, and, indeed, the Warblers generally were among the most vigilant and destructive of their enemies, and must have reduced their numbers greatly. The Finches also, particularly the Chaffinch and House Sparrow, were indefatigable in quest of them; and even the Domestic Poultry sought with avidity for those which, by design or accident, descended to the ground.

In the month of June they underwent their second change, or were converted into chrysalides; and in this almost inactive stage of existence, in which several of the animal functions are suspended, and others are only imperfectly exercised, they displayed an instinct deserving particular notice. Concealed within the cavities which they had formed when caterpillars, by folding down the edges of the leaves and securing them in that position with a little of the glutinous secretion discharged by the spinners, they awaited their final transformation; but, as if aware that so confined a situation would present too many obstacles for a delicate and newly disclosed moth to overcome, without incurring a great risk of sustaining injury, at the important crisis, they made their way to the mouths of their retreats, and protruding themselves as far as they could consistently with security, their exterior covering ultimately gave way, and, in July, the insects made their appearance in the imago or perfect state.

Having procured some of the larvæ of this moth, for the purpose of observing the metamorphoses they undergo, and identifying their species, I put them into clean phials of transparent glass, the perpendicular sides of which they readily ascended by means of lines of their own spinning, after the manner of the caterpillar of the Goat Moth.* This circumstance induced me to try the experiment with the larvæ of other insects. Capturing, indiscriminately, such as came in my way, I soon collected a considerable number; and, on introducing them into the phials, found that several of them made their way up the glass without any apparent difficulty, while others were totally incapable of doing so. These ascents, in many instances, were effected by spinning lines, which were made to answer the purpose of a ladder, as noticed

* Mr. Curtis, in his *British Entomology*, vol. II, plate 60, has given an excellent figure of this caterpillar, representing it in the act of climbing.

above; in some, by the assistance of a slimy or glutinous secretion which left a sensible trace on the glass; and in others, by a method which I cannot satisfactorily explain; the caterpillars, in this case, neither spinning lines, nor leaving any perceptible trace behind them. At first I was disposed to think that their spurious legs, or prolegs, *(propedes,)* as they are denominated by Messrs. Kirby and Spence, in their *Introduction to Entomology*, acted as suckers; and that they were held to the sides of the phials by atmospherical pressure. It soon occurred to me, that the accuracy or inaccuracy of this supposition might be ascertained by means of the air-pump. Under this impression, I applied to Dr. Dalton, who was so obliging as to allow me the use of his instrument, and to lend me his assistance in conducting the experiment. The result, however, proved the reverse of what I had anticipated; for, notwithstanding the pressure was very greatly reduced, the caterpillars were still capable of ascending the phial in which they were enclosed: it is probable, therefore, that some adhesive matter, which, perhaps, is not liable to leave a sensible stain upon glass, may be secreted, in small quantities, by the spurious legs of these larvæ; and that they are thus, in opposition to the attraction of gravitation, enabled to climb up the vertical sides of bodies with smooth and even highly polished surfaces.* A minute examination of the structure of the false legs, under a powerful microscope, might possibly throw some light on this curious subject, which, it must be acknowledged, merits further investigation.

The injury sustained by the oaks, on this occasion, was not limited to those which grow in this particular district. I am well informed, that in other parts of the county, and in Yorkshire, Cheshire, Derbyshire, Shropshire, Middlesex, &c., many were similarly affected; and it is probable that the mischief extended much further. The damage done to the first leaves was, in a considerable degree, repaired by the developement of a second set, about the close of June, and the beginning of July, the lively tints of

* The near approximation of this conjecture to the truth will be rendered apparent when the means by which certain animals ascend the vertical surfaces of highly polished bodies are treated upon.

which gave to our oak woods, at that season of the year, the appearance of spring; but the bloom, as well as the early foliage, having been nearly destroyed, the crop of acorns, which had promised to be unusually abundant, proved remarkably defective.

Various were the opinions entertained as to the cause of this blight, as it was generally termed; it being severally ascribed to disease; to lightning; to the cold winds which prevailed in the spring of the year; and to the ravages of insects. The last conjecture happens to be correct; but few persons gave themselves the trouble to establish its accuracy by actual observation, and still fewer endeavoured to determine the species of those depredators. Their vast multitudes may, with much plausibility, be attributed to the high temperature of the preceding year, 1826, having been extremely favourable to their increase; for, in the same season, many other insects were also very numerous; especially the various species of *Aphis*, and their natural destroyers the *Coccinellæ*. Among the latter, *C. 7-punctata*, *C. 4-pustulata*, and *C. 2-punctata*, greatly predominated. The two last are considered to be distinct, and, accordingly, have had different specific names assigned to them by entomological writers; but that excellent botanist, and attentive observer of the economy of insects, Mr. Edward Hobson, of Manchester, assures me that they are opposite sexes of the same species; *C. 2-punctata* being the male, and *C. 4-pustulata* the female. Some observations of my own, made since I have been in possession of Mr. Hobson's communication, had disposed me to regard *C. 4-pustulata* as the male, and *C. 2-punctata* as the female; but I am now convinced that the colours of the sexes are liable to vary.

Through the kindness of my friend Mr. Peter Barrow, I have been favoured with a sight of the fifty-second number of Mr. Curtis's work on *British Entomology*, which has been published since the above remarks were written. In treating upon *Coccinella Ocellata*, the author observes, that the genus *Coccinella* "is at once a remarkable example of the value of structure in the combination of groups, and of the little importance of the distribution of colour, when employed to distinguish species. As a genus, *Coccinella* is so natural, that its appellation has never been disturbed; whereas, the species composing it are so variable, that many of them have been described under a great variety of names." Mr. Curtis, without alluding to sexual distinctions, brings together the following synonimes under the specific name *dispar*. "*Pantherina* and *annulata* Linn. Don. 7.243.2—*bi-punctata* and 6-*pustulata* Linn. Don. 2.39.3.—*unifascia* and 4-*pustulata* Fab. Don. 7.243.3—*perforata* and 7-*pustulata* Mar. —4-*punctata* Don. 16.542." Recent researches have induced Mr. Hobson to coincide with me in the opinion, that the distribution of colour affords no criterion which will serve to distinguish the sexes of *C. dispar*.

ON THE

MEANS BY WHICH CERTAIN ANIMALS ASCEND THE VERTICAL SURFACES OF HIGHLY POLISHED BODIES.

IN the *Physico-Theology* of Dr. Derham, p. 363, note b, it is stated, that "diverse Flies, and other Insects, besides their sharp hook'd Nails, have also skinny Palms to their feet, to enable them to stick on Glass, and other smooth Bodies, by means of the Pressure of the Atmosphere." This opinion, which appears to be almost universally adopted by the entomologists of the present day, has derived additional weight from the investigations of Sir Everard Home, whose papers relative to this curious subject, illustrated by figures of the parts employed in climbing, engraved principally from drawings made by Mr. Bauer, are published in the *Transactions of the Royal Society* for 1816. These researches are regarded by Messrs. Kirby and Spence (see their *Introduction to Entomology*, vol. II, letter xxiii) as having "proved most satisfactorily, that it is by producing a vacuum between certain organs destined for that purpose and the plane of position, sufficient to cause atmospheric pressure upon the exterior surface, that the animals in question are enabled to walk up a polished perpendicular, like the glass in our windows, or with their backs downward on a ceiling, without being brought to the ground by the weight of their bodies." To dissent from a theory so generally received, including among its advocates numerous illustrious names, may, perhaps, be deemed presumptuous; nevertheless, as facts absolutely irreconcileable with this supposition have been forced upon my attention, while engaged in examining the evidence by which it is supported, I shall, with every sentiment of respect for the high authorities to whom I stand opposed, submit my views to the consideration of candid and intelligent naturalists.

Concerning the structure of the instruments by means of which flies ascend the vertical sides of smooth bodies, various opinions have been promulgated. Some authors compare them to sponges, and conjecture that they are designed to contain a glutinous secretion capable of adhering to well cleaned glass. Dr. Hooke describes them as palms or soles beset underneath with small bristles or tenters, like the wire teeth of a card for working wool, which he conceived give them a strong hold upon objects having irregular, or yielding surfaces; and he imagined that there is upon glass a kind of smoky substance penetrable by the points of these bristles.* According to the observations of Sir Everard Home, they are expanded membranes, having their inferior surface granulated, and their edges beautifully serrated;† while Messrs. Kirby and Spence, on the contrary, remark that they are downy on the under side and granulated above.‡

The want of accordance, so conspicuous in the preceding accounts, induced me to inspect the parts minutely under a good

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* *Micrographia*, p. 170-171.

† *Transactions of the Royal Society* for 1816, p. 323.

‡ *Introduction to Entomology*, vol. 11, letter xxiii.

compound microscope; when it was immediately perceived that the function ascribed to them by Dr. Derham and Sir E. Home is quite incompatible with their organization. Minute hairs, very closely set and directed downwards, completely cover the inferior surface of the expanded membranes, improperly denominated suckers, connected with the terminal joint of the tarsi of flies; the edges of which are plain, not serrated, as Sir E. Home asserts, though, when placed in such a situation relative to the eye of the observer that the hairs in connexion with them are fore-shortened, they certainly present an appearance which, on a superficial view, might lead to the latter conclusion. This circumstance of the under side of the tarsal membranes of flies being densely covered with erect hairs effectually prevents its being brought into contact with the objects on which those insects move, by any muscular force they are capable of exerting: the production of a vacuum between each membrane and the plane of position is, therefore, clearly impracticable, unless the numerous hairs on the under side of these organs individually perform the office of suckers, and there does not appear to be any thing in their mechanism which, in the slightest degree, countenances such a hypothesis. When highly magnified, their extremities, it is true, are seen to be somewhat enlarged; but, whether they be viewed in action or in repose, they never assume a figure at all adapted to the formation of a vacuum.

Satisfied that this difficult problem must admit of a solution more consistent with the various phenomena it comprehends than the popular one here controverted, I determined to institute an experimental investigation of it. Accordingly, having procured living specimens of the House-fly, *Musca domestica*, and of the large Flesh-fly, *Musca vomitoria*, I enclosed them in clean jars and phials of transparent glass, the interior surface of which they traversed in every direction with the greatest facility, walking upon it, even with their backs downward, while they remained in full vigour; but when enfeebled by exposure to cold, or by over exertion, the identical individuals ascended the sides of the same jars and phials with considerable difficulty, falling from them in numerous instances, and they were entirely incapacitated for adhering to them in an inverted position ; yet when their physical energy was restored by repose, or an increase of temperature, they again repeated their most extraordinary feats with all their original promptness and dexterity.

Flies, which are unable to maintain an inverted position on highly polished bodies, will frequently adhere firmly, with their backs downward, to glass rather defective in polish, or slightly soiled: indeed, I may remark generally, that the results of experiments, similar to those detailed above, will always be modified by the vigour of the insects, and the state of the glass vessels with regard to cleanness and polish.

These facts plainly indicate that flies are not supported on the vertical sides of smooth bodies by the pressure of the atmosphere; and the only link in the chain of evidence which was wanting to place the matter beyond all dispute, the kindness of Mr. W. Hadfield, of Cornbrook, has enabled me to supply. With his assistance, and the help of his air-pump, it was proved, to the entire satisfaction of several intelligent gentlemen present, that the House-fly, while it retains its vital powers unimpaired, can not only traverse the upright sides, but even the interior of the dome of an exhausted receiver; and that the cause of its relaxing its hold, and ultimately falling from the station it occupies, is a diminution of physical energy, attributable to impeded respiration. To this circumstance, in particular, as furnishing an *experimentum crucis*, by which the fallacy of the prevailing hypothesis may be established, I am solicitous to direct the attention of naturalists.

I am aware that the males of several Aquatic Beetles have the tarsi of the first and second pairs of legs supplied on the under side with numerous cup-shaped suckers of various sizes, which have their edges (the larger ones at least) beautifully fringed with delicate hairs. These suckers, which probably serve to facilitate the intercourse of the sexes, are remarkably conspicuous on the tarsi of the males of a very common species, *Dyticus marginalis*, and unquestionably give them a firm hold of smooth objects occurring in water, a liquid whose specific gravity rather exceeds their own; but that they are inadequate to the support of this insect, the average weight of which is about twenty-eight grains, on the vertical sides of dry, polished bodies, in so rare a medium as air, I have had frequent opportunities of remarking. My chief object in adverting to these singular organs, on the present occasion, is to guard entomologists against the error of supposing that they correspond to the pulvilli of insects, which, as I have attempted to show, differ from them essentially both in structure and function.

Having demonstrated the insufficiency of the received theory of the movements of flies on polished, perpendicular surfaces, I shall now endeavour to establish a more satisfactory one in its place.

In pursuing my experiments with the House-fly, I observed that individuals sometimes remained fixed to the sides of an exhausted glass receiver, after they had entirely lost the power of locomotion, and an evident distention of the abdomen had been occasioned by the expansion of the aëriform fluids it contained. To detach them from those stations the employment of a small degree of force was found requisite. This occurrence, which first suggested to me the true cause of the phenomena under consideration, induced me to prosecute the inquiry more extensively than I had hitherto done. Selecting clean phials of transparent glass, I placed in them spiders, and various insects in the larva and imago states, capable of walking on their upright sides. I then breathed into the phials till the aqueous vapour expelled from the lungs was copiously condensed on their inner surface. The result was remarkable. The moisture totally prevented those animals from obtaining any effectual hold on the glass; and the event was equally decisive if a small quantity of oil was substituted for the aqueous vapour. A similar consequence ensued also, when the flour of wheat, or finely pulverized chalk, or gypsum was thinly distributed over the interior surface of the phials; the minute particles of those substances adhering to the tarsal brushes of the spiders, the pulvilli of the perfect insects, and the under side of the feet of the larvæ. These facts appeared quite inexplicable, except on the supposition that an adhesive secretion is emitted by the instruments employed in climbing. The next point to be determined, therefore, was, whether spiders, and insects in the larva and imago states, when moving in a vertical direction on clean glass, leave any visible track behind them or not. Careful and repeated examinations, made with lenses of moderately high magnifying powers, in a strong light, and at a favourable angle, speedily convinced me that my conjecture was well founded, as I never failed to discover unequivocal evidence of its truth; though, in the case of the spiders, considerable difficulties presented themselves, in consequence of the exceedingly minute quantity of adhesive matter emitted by the brushes of those animals. On submitting this secretion to the direct rays of the sun, in the month of July, and to brisk currents of air whose drying power was great, I ascertained that it did not suffer any perceptible diminution by evaporation under those circumstances.

Now it is reasonable to infer, from the foregoing researches, that the hair-like appendages constituting the brushes of spiders, and occurring in such profusion on the inferior surface of the pulvilli of insects, are tubular. The delicate membrane also, on the under side of the prolegs, and the tarsi of the perfect legs of various larvæ capable of traversing polished, perpendicular bodies, without the aid of lines produced by a spinning apparatus, must be provided with numerous pores, or minute papillæ, from which an adhesive secretion is emitted. Some larvæ which are not supplied with prolegs, those of the *Coccinellæ*, for example, have the inferior part of the tarsi of their perfect legs thickly covered with hair-like appendages, resembling in figure, and in the function they perform, those on the pulvilli of insects in the imago state; while others, altogether destitute of legs, emit a viscid mucus from both their extremities, and by advancing and attaching each alternately are thus enabled to ascend smooth bodies with facility.

The larvæ of the *Chrysomelæ*, *Coccinellæ*, and some other insects, can protrude through an orifice at the extremity of the caudal or terminal segment of the abdomen, a bundle of papillæ, which, by a copious emission of mucus, gives them so secure an attachment to the objects on which they move, as readily to sustain their entire weight; by assisting them occasionally in the act of progression it is also made to serve the purpose of an additional leg. Provided with a similar apparatus, the larva of the Glow-worm, *Lampyris noctiluca*, though unable to ascend a vertical surface of glass, can adhere to one firmly by the application of this organ, which is composed of several branched, membranous papillæ included in a common envelope. They are extremely flexible and extensile; and, either separately or collectively, can be protruded beyond the caudal segment, or retracted within it, at the pleasure of the animal. Their efficiency as a cleaning apparatus, and an organ of adhesion and progression, depends, principally, upon the mucus they emit, which is secreted in great abundance, and not upon the power of producing a vacuum. When this instrument is applied to the body of the insect, any extraneous matter immediately becomes attached to it, and the impurities thus collected are ultimately expelled by a fresh discharge of mucus and a peculiar motion of the papillæ. Larvæ of the Glow-worm, kept in captivity for the purpose of experiment and observation, may be fed on earth-worms.

In conclusion, I may remark, that snails, it is well known, can adhere to polished bodies by means of a mucous secretion; and from minutely inspecting preserved specimens of tree-frogs, *(Hylæ,)* and the lizards denominated *Geckos*, I am decidedly of opinion that those reptiles are enabled to run upon the vertical sides of smooth objects by the agency of adhesive matter emitted from pores and papillæ situated on the inferior surface of their toes.

OBSERVATIONS AND EXPERIMENTS

ON

AËRONAUTIC SPIDERS,

MADE CHIEFLY WITH A VIEW

TO ASCERTAIN THE MEANS BY WHICH THEY EFFECT THEIR

AËRIAL EXCURSIONS.

ALTHOUGH it is well known that spiders sometimes ascend into the atmosphere through the instrumentality of fine lines of a viscid, gummy matter, which proceed from the mammulæ situated at the extremity of the abdomen, yet the manner in which these aërial journeys are effected still remains involved in obscurity, and considerable diversity of opinion exists as to the particular species of spider by which they are undertaken. This deficiency leaves open a wide field for speculation, and, accordingly, we find that natural historians have ascribed this interesting occurrence to several distinct causes, such as the agency of winds, evaporation, and electricity; the exercise of peculiar physical powers with which Aëronautic Spiders have been supposed to be endowed; and the extreme levity of the lines of those animals, which are represented, by some writers on the subject, to be of less specific gravity than atmospheric air:* but that each of these hypotheses is unfounded, and in direct opposition to facts, will be rendered evident by the following observations and experiments, from which I have endeavoured to elicit a satisfactory solution of the difficulty.

That Gossamer, which usually abounds most in the months of September and October, is perceived to ascend into the atmosphere only in serene, bright weather, is, I believe, generally allowed: it is also admitted, that Gossamer in the air is invariably preceded by Gossamer on the ground. These, as will appear in the sequel, are circumstances of much importance in the present investigation; every method of accounting for the ascent of Gossamer-webs and spiders,

* For a more detailed statement of the above conjectures see the *Introduction to Entomology*, by Messrs. Kirby and Spence, Letter xxiii.

however plausible, which does not imply their concurrence, being necessarily erroneous.

But to proceed to my own researches.—A little before noon, on the 1st of October, 1826, which was a remarkably calm, sunny day, the thermometer in the shade ranging from 55° 5 to 64°, I observed that the fields and hedges in the neighbourhood of Manchester were covered over, by the united labours of an immense multitude of spiders, with a profusion of fine, glossy lines, intersecting one another at every angle, and forming a confused kind of net-work. So extremely numerous were these slender filaments, that in walking across a small pasture my feet and ankles were thickly coated with them. It was evident, however, notwithstanding their great abundance, that they must have been produced in a very short space of time, as early in the morning they were not sufficiently conspicuous to attract my notice; and on the 30th of September they could not have existed at all; for, on referring to my Meteorological Journal, I find that a strong gale from the south prevailed during the greater part of that day.

A circumstance so extraordinary could not fail to excite curiosity; but what more particularly arrested my attention was the ascent of an amazing quantity of webs, of an irregular, complicated structure, resembling ravelled silk of the finest quality and clearest white. They were of various shapes and dimensions, some of the longest measuring upwards of five feet in length, and several inches in breadth, in the widest part; while others were almost as broad as long, presenting an arëa of a few square inches only. These webs, it was quickly perceived, were not formed in the air, as is generally believed, but at the earth's surface. The lines of which they were composed, being brought into contact by the mechanical action of gentle airs, adhered together, till by continual additions they were accumulated into flakes or masses of considerable magnitude; on which the ascending current, occasioned by the rarefaction of the air contiguous to the heated ground, acted with so much force as to separate them from the objects to which they were attached, raising them in the atmosphere to a perpendicular height of at least several hundred feet. I collected a number of these webs, about mid-day, as they rose, and again, in the afternoon, when the upward current had ceased to support them and they were falling; but scarcely one in twenty contained a spider, though, on minute inspection, I found small winged insects, chiefly *Aphides*, entangled in most of them.

From contemplating this unusual display of Gossamer, my thoughts were naturally directed to the animals which produced it; and the countless myriads in which they swarmed almost created as much surprise as the singular occupation that engrossed them. Apparently actuated by the same impulse, all were intent upon traversing the regions of air; accordingly, after gaining the summits of various objects, as blades of grass, stubble, rails, gates, &c., by the slow and laborious process of climbing, they raised themselves still higher by straightening their limbs; and elevating the abdomen, by bringing it from the usual horizontal position into one almost perpendicular, they emitted from their spinning apparatus a small quantity of the glutinous secretion with which they fabricate their silken tissues. This viscid substance, being drawn out by the ascending current of rarefied air into fine lines several feet in length, was carried upwards; until the spiders, feeling themselves acted upon with sufficient force in that direction, quitted their hold of the objects on which they stood, and commenced their journey by mounting aloft.

Whenever the lines became inadequate to the purpose for which they were intended, by adhering to any fixed body, they were immediately detached from the spinners, and so converted into terrestrial Gossamer, by means of the last pair of legs, and the proceedings just described were repeated; which plainly proves that these operations result from a strong desire felt by the spiders to effect an ascent. But what, it may be asked, is the exciting cause of this singular propensity? It has been suggested that hunger, or an inclination to procure some favourite kind of food, may supply the requisite stimulus. These suppositions, however, are discountenanced by the plump appearance which the animals exhibit; by their total disregard of such winged insects as happen to be placed within their power; by their utter inability to regulate their motions, while afloat, in any other manner than by letting out or drawing in the lines by which they are conveyed through the air, and thus promoting their ascent or descent; by the unsuitableness of the lines for securing their prey; and, lastly, by the uncertainty when a favourable day for their purpose may occur, or even that one may occur at all. Were I to hazard a conjecture on the subject, I should be disposed to attribute the manifest anxiety of these animals to change their quarters, to a feeling of insecurity occasioned by their proximity to one another; the prodigious numbers, which in favourable seasons are usually congregated together, affording the more powerful individuals an opportunity, seldom neglected by these voracious creatures, of making an easy prey of the weaker; and this opinion is strengthened, if not confirmed, by the fact, that they are chiefly spiders which have not arrived at maturity that undertake these migrations.

I have asserted, that when Aëronautic Spiders perform their aërial journeys, they are borne upwards by an ascending current of rarefied air impinging against the slender lines which proceed from their spinners.

I shall now endeavour to demonstrate, that this curious atmospherical phenomenon, which well deserves the attention of meteorologists, affords them the only available means of accomplishing their object; and that the hypotheses previously adverted to are quite irreconcileable with facts, and, consequently, must be erroneous.

It has been already stated, that Gossamer is never seen floating in the air except in calm, sunny weather; its buoyancy, therefore, evidently does not depend upon the agency of winds, usually so called: indeed, it is probable that winds never do take an upward direction, unless influenced by some extraordinary circumstance or local peculiarity; the ascent of Gossamer, on the contrary, is frequently observed to take place over a great extent of country on the same day. It was noticed on the 1st of October, for example, in England, Wales, and Ireland.

If a satisfactory explanation of this interesting fact cannot be derived from the operation of winds, it is still less likely to be deduced from the action of evaporation, or electricity; for, not to insist upon the probable, I had almost said absolute, insufficiency of these powers, considered as agents, experiments show that spiders do not select those periods for making an ascent when the evaporating force is unusually great, or the electricity of the atmosphere is remarkable for its intensity.* I find, likewise, that when Gossamer-webs and the larger species of Aëronautic Spiders are raised into the air with facility, the downy feathers of birds and seeds of plants are also carried upwards, whatever may be their electrical condition as induced by artificial means; a convincing proof that the buoyancy of these several objects does not depend upon the influence of electricity. But though each of the alleged causes, just adverted to, appears to be incompetent to produce the required effect, yet one abundantly adequate may, perhaps, be thought to exist in the physical endowments of the animals themselves, or in the extreme lightness of their filaments;

* The evaporating force may be determined by the atmometer; or from the temperature at which the aqueous vapour in the atmosphere begins to be condensed into water, and the temperature of the air. See the *Memoirs of the Literary and Philosophical Society of Manchester, First Series*, vol. v, part 11, p. 588. The electrical state of the atmosphere is shown by Bennet's gold-leaf electrometer.

these two last-named suppositions, therefore, merit a careful examination.

If spiders do impel their lines upwards by the voluntary exercise of some animal function which has hitherto eluded the researches of physiologists, it follows, that when the communication is interrupted, the lines, unless influenced by some other force, must necessarily fall. Now the reverse of this uniformly ensues; for if the animals, after having commenced their ascent, are suddenly separated from the lines to which they are attached, the latter still continue to ascend, their motion being accelerated by the diminished action of gravity upon them, but the former are rapidly precipitated to the ground. The conclusion is obvious. The buoyancy of the lines cannot be occasioned by the beings which produce them; and the ascent of large flakes of web unoccupied by spiders, before alluded to, confirms this opinion.

Perhaps the buoyancy of lines from which spiders have been detached, and of webs altogether destitute of those animals, may be regarded as facts powerfully contributing to establish the accuracy of the idea that this secretion is specifically lighter than the mixed gases which compose the atmosphere. The fallacy of this notion, however, is easily detected by experiment. In the comparatively still air of a room without fire, both the lines and webs descend slowly to the floor, the latter falling with the greater degree of velocity. Were these productions lighter than atmospheric air, or were the spiders capable of effecting an ascent without adventitious aid, a calm though cloudy day might answer their purpose; but as considerable warmth is required to produce an ascending current of rarefied air strong enough to bear them from the earth, a bright as well as still day is indispensable.

A distinguished French naturalist, M. Virey, gives the following result of his observations and experiments on Aëronautic Spiders, in the *Bulletin des Sciences Naturelles* for October, 1829, p. 133. "Réfléchissant aux moyens par lesquels ces insectes gravissent dans l'air, une seule chose m'a paru la plus vraisemblable, c'est qu' à l'aide des huit pattes que l'animal peut faire vibrer avec agilité, *il nage dans l'air*. On conçoit que ces membres rapprochés, ramant quatre à quatre simultanément de chaque côté, frappent l'air comme des aîles, et peuvent fort bien enlever cet insecte d'ailleurs si léger. Ce procédé paraît le seul possible dans ce cas. D'ailleurs l'extrême rapidité, ou l'agilité incroyable de ces pattes en trépidation, comme la vibration des aîles chez les oiseaux ou les insectes diptères qui planent dans l'air, font qu'on ne peut pas toujours bien distinguer leur mouvement." In this bold but fanciful conjecture, M. Virey has been anticipated by our celebrated countryman Dr. Lister; who, in treating upon his "araneus subfuscus, minutissimis oculis è violâ purpurascentibus, tardipes, & gressu & figurâ cancro marino non adeò dissimilis," remarks, "certè egregius funambulus est, & mirificè filorum ejaculatione delectatur: neque solùm in äere, utì superiores, vehitur; sed ipse etiam ascensum velificationémque molitur, pedibus scilicet arctiùs ad se invicem applicitis sese quodammodo librat, cursum promovet regitque nihilo seciùs quàm si illi essent à naturâ concessæ alæ vel remorum ordines."* Supported by such high authorities as these,

* *De Araneis*, p. 85.

this hypothesis assumes an air of importance to which it is not otherwise entitled; since the single fact, that spiders, when sailing in the atmosphere, invariably fall to the ground on being separated from their lines, is alone sufficient to effect its complete subversion. Moreover, I have thoroughly satisfied myself, by much elaborate investigation, that spiders never ascend into the air spontaneously without the assistance of lines connected with the spinners; and that when they perform their aërial journeys, their legs are usually in a state of quiescence, being contracted and brought into close contact with the body: indeed, should the limbs happen to be observed in motion, they will generally be found, on minute inspection, to be employed in adjusting the suspensory filaments, and not in propelling the adventurous aëronauts through the atmosphere. It is manifest, therefore, that, in the strict sense of the word, spiders do not fly.

The various directions in which spiders sail through the atmosphere admit of an easy explanation. A direction parallel to the horizon will be given by a current of air moving in that plane; a vertical one, by the ascent of air highly rarefied; and directions intermediate between these two will, in general, depend upon the composition of forces. When the horizontal and vertical currents are equal in force, the line of direction will describe an angle of 45° nearly with the plane of the horizon; but when their forces are unequal, the angle formed with that plane will be greater or less accordingly as one current or the other predominates.

Founded on results obtained from an experiment which has been frequently made, but never conducted with sufficient care, is the belief, entertained by many eminent naturalists, that spiders can forcibly propel or dart out lines from their papillæ. Now as this process would, contrary to my own experience, imply the exercise of a physical power peculiar to those creatures; and as attempts have been made to explain on this principle the fabrication of the nets of Geometric Spiders in situations where their ordinary mode of proceeding could not be employed, I determined to repeat the experiment from which so strange a conclusion has been deduced. With this view, having procured some small branched twigs, I fixed them upright in glazed earthen-ware vessels with perpendicular sides, containing water; their bases being immersed in the liquid, and upon them I placed several Aëronautic and Geometric Spiders. Whenever the animals thus circumstanced were exposed to a current of air, either naturally or artificially produced, they directly turned the cephalothorax towards the quarter whence it came, even when it was so slight as scarcely to be perceptible; and elevating the abdomen, they emitted from their spinners a small quantity of glutinous matter, which was instantly carried out in a compound line, with a velocity equal, or nearly so, to that with which the air moved, as was apparent from observations made on the motion of detached lines similarly exposed. The spiders, in the next place, carefully ascertained whether their lines had become firmly attached to any object or not, by pulling at them with the first pair of legs; and if the result was satisfactory, after tightening them sufficiently, they made them fast to the twigs; then discharging from their spinners, which they applied to the spot where they stood, a little more of their liquid gum, and committing themselves to these bridges of their own constructing, they passed over them in safety, drawing a second line after them as a security in case the first gave way, and so effected their escape. Such was invariably the result when the spiders were placed where the air was liable to be sensibly agitated: I resolved, therefore, to put bell-glasses over them; and in this situation they remained seventeen days, evidently unable to produce a single line by which they could quit the twigs they occupied without encountering the water at their bases; though, on the removal of the bell-glasses, they regained their liberty with as much celerity as in the instances already recorded.

The manner in which the lines of spiders are carried out from the spinners by a current of air appears to be this. As a preparatory measure, the spinning mammulæ are brought into close contact, and viscid matter is emitted from the papillæ; they are then separated by a lateral motion, which extends the viscid matter into fine lines connecting the papillæ; on these lines the current impinges, drawing them out from the spinners to a length which is regulated by the will of the animal; and on the mammulæ being again brought together the lines coalesce and form one compound thread.

The foregoing experiment, which, from a want of due precaution in its management, has misled so many distinguished naturalists, I have repeated with more than thirty distinct species of spiders, at all hours of the natural day, and in electrical and meteorological states of the atmosphere differing most essentially; in short, under every variety of circumstances which appeared likely to influence the result, yet always with the same success. Placed under bell-glasses, or in any situation where the air remained tranquil, they in vain attempted to make their escape from the twigs to which they were confined, notwithstanding their best endeavours to quit them were persisted in pertinaciously; but in the disturbed atmosphere of an inhabited room most of them readily accomplished their object. I am confident, therefore, in affirming, that, in motionless air, these animals have not the power of darting their lines even through the space of *half an inch.*

Spiders, though placed on excellent conductors of electricity, such as metallic rods insulated by water, if exposed to a current of air, let out their lines with facility, and *invariably in the direction of the breeze.* The act is perfectly voluntary, and the lines, immediately after they are emitted, nay, at the very time they are issuing from the spinners, if blown upon from any other quarter, instantly obey the new impulse thus imparted to them. I have tried this experiment many hundred times without once perceiving the slightest deviation from these results, which I, therefore, regard as completely established.

All spiders possessing an apparatus for spinning do not appear to be endowed with the instinct to let out their lines when placed on a twig insulated by water and exposed to a current of air; and as this is the case with some of the more common species, with the *Aranea domestica* of Fabricius, and the *Clubiona atrox* of M. Latreille, for example, I take this opportunity of calling the attention of observers to the fact, which, if unnoticed, might occasion them some disappointment.

In conducting experiments similar to those described above, it will be very apparent, that there is a decided advantage in employing, as I have recommended, vessels having smooth, perpendicular sides, care being taken not to fill them with water; for several kinds of spiders run upon that liquid with greater facility than they do on land; and though most of our larger indigenous species are, at least when they have attained their full growth, quite incapable of walking upon its surface, still they sometimes contrive to effect a passage over it by the following ingenious expedient. Placed on an insulated twig, they attach a line to it which they seize with the foot of one of the hind legs, allowing it to run freely through the claws as it proceeds from the spinners. Descending to the surface of the water, they use their best exertions to pass over it; and should a little dust or other extraneous matter happen to rest upon it, enabling them to obtain even a slight footing, their efforts are frequently attended with success; the line, which chiefly contributes to support them during their progress, and also serves to secure a return to the twig, should their attempts prove abortive, being ultimately made fast to the edge of the vessel containing the liquid. Various species of spiders occasionally proceed down the twig into the water, and endeavour to walk over the bottom of the vessel; the atmospheric air, confined among the hairs with which they are clothed, and enveloping in a greater or less degree their limbs and body, empowering them to remain immersed, for a short period, without suffering much inconvenience. When the experiments are made with Hunting Spiders, a vessel of considerable internal dimensions should be selected; for, if this precaution be neglected, some species, *Salticus scenicus*, for example, will escape by leaping over the water intended to confine them; and, on such occasions, a line, attached by its extremity to the station previously occupied by each individual, is drawn out after it from the spinners.

Some Aëronautic Spiders, procured on the 2nd of October, 1826, were enclosed in glass phials with ground stoppers, where they were suffered to remain till the 16th of December, an interval of seventy-five days, without either food or moisture; yet, at the expiration of that period, the only alterations perceptible in their external condition were a small decrease in bulk, and a slightly wrinkled appearance, particularly of the abdomen; but their functions were, seemingly, unimpaired; for on warm days, or when excited by artificial heat, they were lively in their motions, and to the last continued to produce their lines, which were often destroyed for the purpose of ascertaining whether they would be replaced by others or not, with the same facility, apparently, as at the time of their capture. It is particularly deserving of notice, that these animals, though unable to climb up the smooth perpendicular sides of the phials on their first introduction, soon contrived to traverse the interior of their prisons in every direction.

In order to illustrate their manner of proceeding on this occasion, the case of an individual has been selected for description; the same method, with a few trivial modifications, being pursued by all. Elevating the abdomen, and pressing the spinning apparatus against the side of the phial, this spider emitted from its papillæ a little viscid fluid, which, on exposure to the air, hardened into a minute, semi-transparent speck; then moving to a short distance, and drawing out a line after it, one end of which remained fixed to the spot it had just quitted, it connected this filament with another part of the phial by applying the spinners as before. Several lines being thus produced, the spider, speedily raising itself upon them above the bottom of the phial, promoted its undertaking by repeating the process just described; every step so gained enabling it to carry its operations still higher. From the cylindrical figure of the phial, it follows, that all the lines attached to its sides by their extremities, such as were vertical alone excepted, formed with those sides chords to arcs of various magnitudes. Lowering itself from one of these chords to another, and applying the spinners to each in succession, the spider soon connected the whole of them together by a line; then ascending again to the greatest altitude it could attain, and dropping down by a line to the bottom of the phial, over which it walked to the opposite side, it there drew the filament tight and made it fast, having prevented it from coming in contact with the glass previously by raising the abdomen a little. To this oblique line it united others, extending them in different directions, till, by these means, it established a communication with every part of the phial. As there was some difficulty in tracing these operations with the unassisted eye, lenses of the magnifying powers of six and eight were employed.

The spiders, seen ascending into the atmosphere on the 1st of October, were of two distinct species; the *Thomisus cristatus* of M. Walckenaër, and the *Lycosa saccata* of M. Latreille. The species, noticed by me as remarkable for the skill it displayed in spinning its way up the sides of the phial in which it was confined, and for having existed seventy-five days without food or moisture, was *Thomisus cristatus*; *Lycosa saccata* being neither so expert in climbing, nor so tenacious of life under similar circumstances. The largest individuals of the first species, observed to undertake aërial journeys, measured $\frac{1}{6}$th of an inch between the extreme points of the head and abdomen; $\frac{1}{10}$th of an inch across the broadest part of the abdomen; and weighed about a quarter of a grain. The largest individuals of the second species, seen floating in the air, were of somewhat inferior weight and dimensions.

Another spider, of a diminutive size, remarkable for the frequency of its ascents, is the one named by me *Erigone atra*, which appears to be identical with the *Aranea obtectrix* of Bechstein.

Aëronautic Spiders, properly so called, or those species which *instinctively* employ their lines to sail in the atmosphere, will probably be found, almost exclusively, among such as are active during the day and decidedly erratic. Numerous facts tend to corroborate this idea, the correctness or inaccuracy of which can only be determined by more extended observations.

ON THE MANNER IN WHICH THE

GEOMETRIC SPIDERS

CONSTRUCT THEIR NETS.

FEW animals of solitary habits are endowed with more extraordinary instincts than spiders. The ardent affection for their offspring, so strikingly manifested by some species; the exquisite skill displayed by many in fabricating silken cocoons to contain their eggs, and in the construction of their habitations; the highly curious contrivances by means of which others traverse the regions of air, or descend beneath the surface of water; and the various stratagems had recourse to by all, in eluding their numerous enemies and in securing their living prey, are eminently calculated to attract the attention and elicit the admiration of every person who has a mind alive to the wonderful physiological phenomena exhibited by the inferior orders of animated beings. But interesting as the general economy of this remarkable tribe of animals is, and well deserving of more minute investigation than has hitherto been bestowed upon it, on the present occasion I purpose to limit my observations to the manner in which several British species of Geometric Spiders construct their snares.

By the elegance of their symmetrical structure, and their extreme delicacy of texture, the nets of these uneducated geometricians never fail to excite astonishment, even in the most thoughtless observer; and the pen of the natural historian has been frequently employed in describing the singular process by which they are formed. Among the various authors whose works I have consulted, Messrs. Kirby and Spence have given the most circumstantial account of this process, in their comprehensive and excellent *Introduction to Entomology*, vol. I, letter XIII; I shall, therefore, avail myself of what those gentlemen have done, without reserve; introducing such particulars, in addition, as have resulted from my own researches, and attempting to solve a few of those difficulties which they have left without explanation.

The Geometric Spiders usually suspend their nets in an oblique or nearly vertical position; fixing them to trees, shrubs, plants, buildings, &c., in places where the insects they prey upon abound. After selecting a suitable situation for her purpose, the spider's first operation, in most instances, is to enclose an arëa, the figure of which appears to be a matter of indifference, with lines of her own spinning. This is effected by proceeding along the objects immediately surrounding the space destined to be occupied by the net, and attaching to several points, by pressing the spinners against them, a line drawn out after her in her transit from one to another. These marginal lines she strengthens with a few additional ones, and finally gives them the requisite degree of tension, by applying to them, in different directions, numerous smaller threads. Having thus completed the foundations of her snare, in the next place she commences to fill up the outline. Fixing a thread to one of the boundary lines, along which she walks, she guides the filament, produced in her progress, with one of her hind feet, that it may not touch in any part and adhere prematurely; and crossing over to the opposite side, she there attaches it firmly, by applying her spinners. To the middle of this diagonal thread, which is to form the centre of the net, she fixes a second, which, in like manner, she conveys and fastens to another part of the lines encompassing the arëa. Along this last-formed thread she returns, drawing out another after her, which, as she does not employ any means to keep it distinct, becomes connected with that on which she is advancing, and is ultimately glued by its extremity to the centre of the net. In this manner, but without observing any regularity in the order of her progression, she forms about twenty or thirty radii, composed of double lines, diverging from the centre to the circumference, and giving the net the appearance of a wheel. She then proceeds to the centre, turns herself round, and pulls each radius with her feet, to ascertain its strength, breaking such as seem defective, and replacing them by others. Her next proceeding is to produce, round the centre of the net, a spiral line extending thence to the circumference, and intersecting the radii, to which she attaches it by pressing her spinners against them. This spiral line, a few of the more central circumvolutions of which are much nearer to each other than are those removed to a greater distance from that point, serves as a temporary scaffolding for the spider to walk over, and also to keep the radii properly stretched during her succeeding operations. It, together with the radii and marginal lines, is composed of unadhesive silk; but a spiral line has now to be spun, from the circumference around the centre, which may be regarded as constituting the most important part of the snare. It consists of a fine thread, closely studded with minute dew-like globules, easily separable from each other by extending the elastic filament on which they are arranged. They are, in fact, globules of viscid gum, as is proved by their adhering to the finger and retaining dust thrown upon the net, while the unadhesive radii and exterior threads remain unsoiled. These viscid threads alone retain the insects which fly into the net, and as they lose their adhesive property by the action of the air, it is requisite that they should be frequently renewed, a process not neglected by the spider, which evinces a perfect consciousness of its necessity. Placing herself at the circumference of the net, and fastening her viscid thread to the end of one radii, the spider walks up that radius towards the centre, till she comes in contact with the last produced circumvolution of the unadhesive spiral line, along which she passes to the adjoining radius, drawing out the thread, in her transit, with the claws of the hind leg nearest to the circumference. She then transfers the thread to the claws of the other hind leg, and passing down the radius, at which she has just arrived, towards the circumference, she places the foot of the hind leg, previously employed in drawing out the thread, on that point in the radius to which her filament is to be attached, and, bringing the spinners to the spot, there makes it secure. The precise place in each radius, at which to fix the thread, is always ascertained by the situation of the foot of the hind leg; and this is determined by touching, with the feet of those legs nearest to the circumference, the marginal line, or, when the structure of the net is further advanced, the last-formed circumvolution of the viscid spiral line. As this last line approaches the several circumvolutions of the unadhesive spiral line, the spider bites them away, being sensible that they are no longer of any use to her; and this fact explains why they are never seen intermixed with the circumvolutions of the former in finished nets. The viscid spiral line, whose circumvolutions are nearly equidistant, being separated by a space, varying, according to the size and species of the animal, from about a thirtieth to six or seven-tenths of an inch, is thus produced till it extends to the most proximate circumvolutions of the unadhesive spiral line, which, occupying the central part of the net, are suffered to remain; it is then discontinued, and the spider, making choice of some retired spot in the vicinity, there constructs a cell, or selects a situation in which she may conceal herself from observation. From the centre of the net to this retreat she spins a line of communication, composed of several threads united together throughout their entire length, the vibrations of which speedily inform her of the capture of her prey; and here her labours terminate.

Such is the process, with some slight modifications now to be noticed, employed by the Geometric Spiders in the formation of their snares. One species, the *Epeira calophylla* of M. Walckenaër, generally converts a radius into a line of communication between the net and its retreat, instead of spinning a separate line for that purpose; and this peculiar appropriation, whether the radius be in the plane of the snare, or whether it be withdrawn from that plane, as is frequently the case, imparts an unfinished appearance to the net, as it prevents the spider from giving her viscid line a spiral form, though this is sometimes attempted with a greater or less degree of success. No sooner does the spider arrive at one of the radii adjacent to that in connexion with her cell, than she returns, traversing the frame-work of her snare till she arrives at the adjoining radius on the opposite side, when she again retraces her steps, and, thus oscillating between the two, spins a a number of curved, viscid lines, or arcs of circles, diminishing in length from the circumference of the net towards the centre. Dr. Lister, who has figured and described this species in his treatise *De Araneis*, fig. x, p. 47-8, was well acquainted with this peculiarity, so common in the structure of its snare; but he has fallen into the error of supposing that it occurs invariably, as appears from the following passage, cited from his work. "Rete amplum & elegantissimum tendit: illud autem in eo perpetuum & singulare est, nimirùm è radiis unicum *maculis utrinque nudari*, ídque è centro reticuli ad ejus usque circumferentiam; qui ferè ad aliquam in pariete rimulam aut alibi, ubi animal tutò totum diem latet, porrigitur: atque hic radius ei velut scala est, per quem ascendat descendatque."

The learned authors of the *Introduction to Entomology*, in treating upon the construction of the nets of Geometric Spiders, (for their remarks, though limited to the proceedings of an individual for the convenience of description, seem to be intended to apply to all,) state, that the spider always leaves a vacant interval round the smallest, first spun circles which are nearest to the centre, but for what purpose they are unable to conjecture; and that, lastly, she bites away the small cotton-like tuft which united all the radii at the centre of the net, and in the circular opening, resulting from this procedure, she takes her station and watches for her prey. In this account I recognize the proceedings of a spider, the *Epeira inclinata* of Walckenaër, which, as far as my own observations extend, never, like the last species, converts a radius into a line of communication with its retreat; and when it occupies the aperture in the centre of its snare, a thread from its spinners is generally connected with the innermost circumvolution of the unadhesive spiral line, by means of which it quickly lowers itself to the ground, when suddenly disturbed. But there are other species which rarely, if ever, leave a vacant interval, of any considerable magnitude, round that portion of the unadhesive spiral line allowed to remain near the centre of the net; neither do they form an opening at the centre, which, almost invariably, is left entire.

The reason why the viscid spiral line is not continued to the centre of the net is obvious, for by this arrangement the spider is enabled to superintend her toils without incurring the risk of being entangled in them.

The species referred to by Messrs. Kirby and Spence, as always leaving a vacant interval round the smallest, first spun circles which are nearest to the centre of her net, produces fewer of those small circles than any other Geometric Spider which has fallen under my notice, except the long slender-bodied species, *Tetragnatha extensa*, Latreille, whose economy is very similar; consequently, if the viscid line were prolonged till it made a near approximation to them, the unadhesive lines about the centre would be too closely circumscribed, and the spider would be subjected to great inconvenience.

Hitherto I have supposed the spider to form her snare in places evidently easy of access to her; but it is not unusual to see nets fixed to objects between which it is quite impossible that a communication can have been established by any process alluded to above; between distant plants, for example, growing in water. "Here then," as the authors of the *Introduction to Entomology* observe, "a difficulty occurs. How does the spider contrive to extend her main line, which is often many feet in length, across inaccessible openings of this description?" To this curious fact my attention has long been directed, and I have thoroughly satisfied myself by observation and experiment, that, in such instances, spiders invariably avail themselves of currents of air, by which their lines are sometimes conveyed to a surprising distance.

If the Geometric Spiders be placed on twigs, or metallic rods, set upright in glazed earthen-ware vessels with perpendicular sides, containing a sufficient quantity of water completely to immerse their bases, the spiders, thus insulated, use every means in their power to effect an escape; all their efforts, however, uniformly prove unavailing in a still atmosphere; nevertheless, when exposed to a current of air, or when gently blown upon with the breath, they immediately turn the abdomen in the direction of the breeze, and emit from the spinning apparatus some of their liquid gum, which, being carried out in a line by the current, becomes connected with some object in the vicinity. This the spider ascertains by pulling at it with her feet, and, drawing it in till it is sufficiently tense, she gums it fast to the twig, or rod, and, passing along it, speedily regains her liberty.

Now, that the same means are frequently resorted to by spiders in their natural haunts, for the purposes of changing their situation and fixing the foundations of their snares, I have repeatedly observed. I am aware that, in the *Introduction to Entomology*, an objection has been urged against the explanation of the difficulty here insisted upon. "If," say the learned authors, "the position of the main line be thus determined by the accidental influence of the wind, we might expect to see these nets arranged with great irregularity, and crossing each other in every direction; yet it is the fact, that however closely crowded they may be, they constantly appear to be placed not by accident but design, commonly running parallel with each other at right angles with the points of support, and never interfering." In favourable weather, it is well known that the Geometric Spiders usually begin to construct their nets soon after the close of day, and as similar processes must be influenced in a like manner by the simultaneous operation of the same cause, the lines of individuals, carried out by a current of air till they become attached to some distant object, will be all parallel or nearly so. This regularity, therefore, instead of militating against the opinion maintained above, appears to me to furnish a powerful argument in support of it.

Sometimes the Geometric Spiders suspend their nets in places not entirely surrounded by objects to which, in the first instance, they can proceed and attach their boundary lines. In such cases their operations are deserving of attention. After spinning a few radii, which are fixed to several distant points most accessible to her, the spider fastens a thread to one of them, gluing it to that extremity which is furthest from the centre of her net. Along this radius she walks, drawing out the thread after her, and guiding it with one of her hind feet, till she reaches its point of union with one of the adjoining radii: on to this radius she steps, and passing along it to the other extremity, there makes fast her thread; by this simple process connecting, with marginal lines, distant objects between which no direct communication previously existed.

In the formation of their nets spiders are regulated chiefly by the sense of touch, which they possess in high perfection. This is rendered extremely probable by the general tenor of their proceedings; for example, they ascertain when they have the full complement of radii by approaching the centre of the net, which is their common point of union, and touching each in succession with the feet, supplying deficiencies wherever they are perceived; and I have already remarked, (which greatly tends to confirm this opinion,) that they generally construct their snares in the night. The fact, however, is established beyond dispute by the following circumstance. I have repeatedly confined Geometric Spiders in glass jars placed in situations absolutely impervious to light, and yet, during their captivity, they have produced perfect nets of admirable workmanship.

Spiders were supposed by Dr. Lister* to be able to retract their threads within the abdomen; and whoever minutely observes the geometricians, when fabricating their silken snares, will be almost induced to entertain the same belief. The viscid line, produced in the spider's transit from one

* *De Araneis*, p. 8.

radius to another, is sometimes drawn out to a much greater extent than is necessary to connect the two; yet, on approaching the point at which it is to be attached, it appears rapidly to re-enter the spinners, till it is reduced to the exact length required. This optical illusion, for such it is, is occasioned by the extreme elasticity of the thread, which may be extended several inches by the application of a slight force, and, on its removal, will contract into a minute globule of almost inappreciable dimensions. The viscid line alone possesses this property in an extraordinary degree, (the radii and marginal lines being scarcely remarkable for it,) by which it is adapted to the frequent and rapid changes in distance that take place among the radii when the net is agitated by winds or other disturbing forces; and by which the insects that fly against it are more completely entangled than they otherwise could be, without doing extensive injury to the frame-work of the snare. How this viscid line is fabricated is at present unknown. An examination of its structure, and of the apparatus by which it is produced, would furnish interesting employment for the microscope.

In order to determine whether objects entangled in their toils are animate or inanimate, the Geometric Spiders pull with their feet the radii immediately in connexion with that part of the snare in which they are suspended, and, suddenly letting go their hold, produce, by this means, a vibratory motion in the net, which seldom fails to excite to action such insects as are ensnared. Guided by the struggles of her prey, the spider runs along the most contiguous radius to seize her victim, avoiding any contact with the viscid line as much as possible, and drawing out after her a thread attached to one of the lines near the centre of her net, which serves to facilitate her return.

Complicated in structure, elegant in design, and admirably adapted to effect the purpose for which they are intended, the nets of the Geometric Spiders may, nevertheless, be shown by experiment to result from a propensity to construct inherent in those animals; for when their eggs are hatched in glass jars, apart from every species belonging to their tribe, the newly disclosed young, acting under the stimulus of hunger, not only fabricate snares, prior to having acquired the slightest knowledge of their prey, but, even in their earliest attempts to accomplish their object, display as consummate skill as the most experienced individuals.

Previously to giving these remarks publicity, I would gladly have availed myself, to a greater extent than I have hitherto done, of the labours of our continental neighbours in this department of natural history; the accomplishment of this intention, however, has been prevented by various unforeseen obstacles: indeed, I am well informed that the works of M. Walckenaër, who is regarded as the highest authority on this subject, are out of print, and cannot be procured either in London or Paris. A book descriptive of British Spiders, if ably conducted, and accompanied with accurately coloured engravings illustrative of species, would, I do not doubt, be favourably received by the naturalists of this kingdom. That such a publication should still be a desideratum in the country which has produced a Ray, a Lister, and a Willughby is a humiliating reflection.

OBSERVATIONS

ON THE

STRUCTURE AND ECONOMY

OF

SPIDERS.

AMONG the various species of *Araneidæ* which capture their prey by means of snares composed of the animal secretion emitted from their spinners, it would be difficult to select any, the Geometric Spiders alone excepted, whose structure and economy are better deserving of investigation than those of *Clubiona atrox*. Whoever inspects closely the web of this very common species cannot fail to be struck with the singularity of its appearance, and will naturally feel a desire to be made acquainted with the process employed in its formation. Such, at least, has been the case with myself; and I have experienced no small degree of disappointment, in not being able to obtain any information on the subject from those authors whose works I have had an opportunity of consulting. This unsuccessful examination of the labours of naturalists, many of them distinguished for the extent of their learning, the minuteness of their researches, and the comprehensiveness of their views, induces me to believe it probable that the inquiry may not have had that attention bestowed upon it which it undoubtedly merits. As it is one, however, which, for some time past, has occasionally occupied a portion of my leisure hours, I shall proceed to detail the results of my observations; trusting that if they should not possess that novelty which, notwithstanding my limited knowledge of the writings of foreign zoologists, I am disposed to claim for them, still they will not be found wholly devoid of interest.

The favourite haunts of *Clubiona atrox* are the branches of trees and shrubs growing against buildings; crevices in old walls; and the corners of windows. In these, and similar localities, it fixes its residence and fabricates its snare. On the objects surrounding the spot selected for its retreat, it extends to a considerable distance, but without any apparent regularity of design, a number of fine, glossy lines intersecting each other at various angles, to which it attaches other lines, or rather fasciculi of threads, of a more complicated structure, and of a pale blue tint, nearly approaching the colour of skimmed milk. These compound threads, or flocculi, which in exposed situations retain their delicate hue for a short period only, (old webs being generally of a dull or sullied white, not at all advantageous to their appearance,) are arranged on the first spun glossy lines both in longitudinal and transverse directions. When recently produced, they adhere strongly to such insects as come in contact with them, and, though perfectly inelastic, may be drawn out into fibres of extreme tenuity. A communication between the snare of this spider and its retreat is established by means of a funnel-shaped tube, of a slight texture, whose smaller extremity is in immediate connexion with the latter, and, indeed, sometimes constitutes the animal's abode. Not unfrequently two or more tubes occur in the same web, by one or other of which the spider usually effects its retreat when disturbed.

If a newly formed flocculus be minutely examined under the microscope, with a pretty high magnifying power, it will be found to consist of six lines. Two of these filaments are straight and exceedingly attenuated; and upon each of them is disposed a tortuous, white line, inflected into short curves and loops, like a ravelled thread of fine silk. A pale blue band, thickly distributed on each of the inflected lines in numerous irregular curvatures, completes the flocculus. The flexures of the pale blue bands are more widely extended than those of the white, tortuous lines on which they occur, and to them the adhesive property of the snare is chiefly to be ascribed. In attempting to determine by experiment the cause of adhesion in the blue bands, I ascertained that bodies with highly polished surfaces, such as the bulbs of thermometers and burnished metallic rods, if carefully applied to them, may be withdrawn without deranging their structure, though the viscid globules in the nets of Geometric Spiders adhere to the same bodies as soon as they are brought into contact with them. From this circumstance I was led to infer that the blue bands are fibrous, although their structure is so exceedingly fine that I cannot detect it even with the assistance of the microscope, and that the imperceptible filaments of which they are composed adhere to objects, not in consequence of being glutinous, but solely by attaching themselves to inequalities on their surfaces. The following brief description of the manner in which the flocculi are fabricated, and of the curious apparatus employed in the process, gives additional weight to this opinion.

There are on the upper joint of the tarsi of the posterior legs of *Clubiona atrox* two parallel rows of spines, moveable at the pleasure of the animal, which may readily be discerned by means of a lens having a magnifying power of ten or twelve. They are situated upon a prominent ridge on the abdominal side of the superior region of the joint, commencing just below its articulation with the tibia, and terminating in a strong spur near its lower extremity. The spines composing the upper row have a considerable degree of curvature, and taper gradually to a fine point; those of the lower row being stronger, more closely set, and less curved.

inclined towards each other, the two sets, in the performance of their functions, describe a series of acute angles whose vertices are directed down the joint. This important appendage constitutes a striking character, which ought on no account to be omitted in descriptions of *Clubiona atrox*.*

When the spider purposes to form a flocculus, it presses its spinners against one of the glossy lines composing the foundation of its snare, and, emitting from them a small quantity of liquid gum, attaches to it several fine threads drawn out by advancing the abdomen a little, and kept distinct by extending the mammulæ laterally. The hind legs are then raised above the plane of position, and the foot of one of them is applied to the superior part of the upper tarsal joint of the other, a little above its articulation with the lower joint of the tarsus, and the curious apparatus of spines, before described, is brought immediately beneath the spinners, at right angles with

* From what is stated relative to the web of *Clubiona ferox,* in the *Faune Française, Aranéides,* p. 152, it is evident that this species also must possess a comb, which, like *Clubiona atrox,* it employs in the construction of its snare.

the line of the abdomen. By a slight extension of the joints of the hind legs the apparatus is forced backwards across the mammulæ, the diverging extremities of which it touches in its transit, and is restored to its former position by a corresponding degree of contraction in the joints. In proportion to the continuation of this process, (and it is not at all unusual for the spider to pass its spiny apparatus across the points of the mammulæ several hundred times in rapid succession,) the inflected lines of the flocculus are found to be produced, the spider making room for them as they accumulate, by elevating and at the same time advancing the abdomen in a small degree, which it effects by slightly extending the joints of the third pair of legs, and contracting those of the two anterior pairs. As this operation is generally accomplished in the night, it can seldom be seen to advantage unless artificial light be employed, some skill in the management of which is required in order to avoid disturbing the spider. The *modus operandi*, as nearly as I can ascertain it by the most diligent observation, appears to be this. The points of the lower row of spines are protruded between those of the upper row, and in passing across the extremities of the mammulæ comb out the tortuous lines, which run into numerous flexures in consequence of not being kept fully extended. The purpose subserved by the upper row of spines seems to be the extrication of the tortuous lines from the spines of the lower row, by a slight motion outwards, which disengages their points. Now, were the blue bands glutinous, this mode of proceeding would be quite unavailing; it is only on the supposition, therefore, that they have a fibrous structure, that their adhesive property can be satisfactorily explained. When a sufficient quantity of the inflected filaments is produced, the spider again applies its spinners to one of the glossy lines, and attaches the flocculus to it. In this manner it proceeds with its labours, occasionally employing the combing apparatus of both hind legs, till the web is completed. Should any of the flocculi be destroyed, or rendered almost useless by having their adhesive property impaired, new ones are constantly added to the snare.

A more exact idea of the mechanism of the combing apparatus, than can be conveyed in words, will be obtained by inspecting Plate 1, fig. 1 and 2.

Distinguished naturalists have represented spiders as having their tarsi armed at the extremities with three claws, which occupy the upper and anterior portion of the foot. That this is the case with some species cannot be denied; other species, however, belonging to various genera, *Mygale avicularia*, *Clubiona erratica*, *Drassus nitens*, *Hecaërge maculata*, *Philodromus pallidus*, and *Salticus scenicus*, for example, have only *two claws* on each foot; and if the tarsi of the larger Geometric Spiders indigenous to Great Britain, such as *Epeira cicatricosa*, *Epeira quadrata*, *Epeira Diadema*, and *Epeira apoclisa*, be examined under the microscope with a highly magnifying power, it will be distinctly perceived that the inferior part of their feet is provided with several claws, which have a considerable degree of curvature, are finely pointed, and are furnished with tooth-like processes on the under side; (Plate 1, fig. 3;) and should the investigation be extended to other retiary spiders, the feet of many species, which construct complicated snares, will likewise be found to exhibit a similar organization. As the best means of guarding against errors, to which the inspection of limbs defective in structure might conduce, it is advisable to select the legs of vigorous individuals which have recently moulted, whenever such can be procured.

The supernumerary claws were first observed by me in examining the feet of *Epeira apoclisa;* and in every instance I counted as many as five, which, with the three upper ones, previously known, give a total of *eight claws* on the same foot, distinguishable at a glance from the coarse, setaceous bristles in their vicinity. There is also a strong, moveable spine, inserted near the termination of the tarsus of each posterior leg, on the under side, which curves upwards at its extremity, and exhibits a slight irregularity of outline at its superior surface. The function performed by these spines is an important one. By the contraction of their flexor muscles they are drawn towards the foot, and are thus brought in immediate opposition to the claws, by which means the animal is enabled to hold with a firm grasp such lines as it has occasion to draw from the spinners with the feet of the hind legs, and such also as it designs to attach itself to. Now, as the spines and the spinning apparatus are the most efficient instruments employed by the Geometric Spiders for the purpose of suspension, it is obvious why they usually direct their heads downwards when they occupy the centre of their nets.

As several difficulties present themselves in the prosecution of these researches, occasioned, chiefly, by the impracticability of comprising all the claws in one distinct view, and as I have not yet succeeded in procuring instruments of sufficient delicacy to enable me to accomplish the dissection of exceedingly minute objects under the microscope, I cannot completely satisfy myself, at present, whether the number and arrangement of the additional claws are uniformly the same, on the feet of such spiders as I have ascertained to be supplied with them, or not; though, as regards the larger species, I am thoroughly convinced that this is the case, and I have reason to think that it will ultimately prove to be so with the rest.

It is not at all surprising that the Geometric Spiders, which employ their feet in the fabrication of complicated nets, should have them more amply provided with claws than those species which use theirs principally as instruments of progression. An estimate of the number of viscid globules, distributed on the elastic spiral line, in a net of *Epeira apoclisa* of a medium size, will convey some idea of the elaborate operations performed by the Geometric Spiders in the construction of their snares. The mean distance between two contiguous radii, in a net of that species, is about seven-tenths of an inch; if, therefore, the number 7 be multiplied by 20, the mean number of viscid globules which occur on one-tenth of an inch of the elastic spiral line, at the ordinary degree of tension, the product will be 140, the mean number of globules deposited on seven-tenths of an inch of the elastic spiral line; this product multiplied by 24, the mean number of circumvolutions formed by the elastic spiral line, gives 3,360, the mean number of globules contained between two radii; which multiplied by 26, the mean number of radii, produces 87,360, the total number of viscid globules in a finished net of average dimensions. A large net, fourteen or sixteen inches in diameter, I have found, by a similar calculation, to contain upwards of 120,000 viscid globules, and yet *Epeira apoclisa* will complete its snare in about forty minutes, on an average, if it meet with no interruption. Astonishingly great as this number of globules is, each is separated from those adjacent to it by a sensible space: indeed, the material of which they are composed is so fluid, that they run together the moment they are brought into contact. The globules and the intervals between them may be distinctly seen with the assistance of a magnifier of the power of ten; and it would appear from the following passage, extracted from *Micrographia*, p. 202, that they did not escape the notice of Dr. Hooke. "I observed further," he informs us, "that the radiating chords of the web were much bigger and smoother than those that were woven round, which seemed smaller, and all over knotted or pearled with small transparent globules, not unlike small crystal beads or seed pearls, thin strung on a clew of silk; which, whether they were so spun by the spider, or by the adventitious moisture of a fog (which I have observed to cover all these filaments with such crystalline beads,) I will not now dispute."

Messrs. Kirby and Spence, in their *Introduction to Entomology*, vol. I. letter XIII, state, that "the net of the Garden Spider is composed of two distinct kinds of silk; that of the radii not adhesive, that of the circles extremely viscid:" and this difference, they remark, "when it is considered that both sorts proceed from the same instrument, is truly wonderful." The fact, however, is even more extraordinary than it is represented to be by those distinguished naturalists; for not only the Garden Spider, but every Geometric species, with which I am acquainted, employs *three* distinct kinds of silk, if a liquid gum can with propriety be termed silk, in the construction of its net. The boundary lines, radii, and first formed spiral line being unadhesive, and possessing only a moderate share of elasticity, are evidently composed of a different material from the last formed spiral line, which is exceedingly viscid, and elastic in a remarkable degree. Now, the viscidity of the elastic spiral line may be shown to depend entirely upon the globules with which it is studded; for if they be removed by careful applications of the finger, a fine, glossy line remains, which is highly elastic, but perfectly unadhesive. As the globules, therefore, and the line on which they are disposed, differ so essentially from each other, and from the rest of the snare, it is reasonable to infer that the physical constitution of these several portions of the net must be dissimilar.

When exposed to the desiccating influence of the sun, and of air briskly agitated, the nets of Geometric Spiders speedily lose their adhesive property; but when formed in situations from which light is excluded, and where the atmosphere is not liable to be perceptibly disturbed, I have known them retain their viscidity for a long period. In a net of *Epeira Diadema*, constructed in a glass jar, which was placed in a dark closet, where the temperature was not subject to great or sudden fluctuations, the globules preserved their adhesive power, almost unimpaired, and the last formed spiral line its elasticity, for more than seven months.

The belief that spiders are incapable of ascending the perpendicular surfaces of polished bodies, without the assistance of lines emitted from their spinners, is so widely extended, that an attempt to prove its fallacy in particular cases will, in all probability, be received with some distrust: nevertheless, the fact that several species have the power of traversing vertical panes of window-glass, in any direction whatever, unsupported by a single filament, may be easily confirmed by experiment. Among the British Spiders, observed to ascend with facility well cleansed windows, and the sides of glass jars in which they have been confined, I may name *Clubiona accentuata*, *Drassus nitens*, *Hecaërge maculata*, *Philodromus pallidus*, and *Salticus scenicus*. The last species is extensively known, and may be readily procured in warm, sunny weather in summer, on the walls of old buildings having a southern aspect.

On examining the legs of these animals under the microscope, with a view to discover the means by which they support themselves in opposition to gravity, I perceived that the tarsi are provided, on the under side, with numerous appendages curving downwards, which are slender at their bases and dilated towards their extremities. The idea immediately occurred to me, that these appendages may perform the office of suckers, and that the spiders are probably enabled to adhere to the upright sides of smooth objects by atmospherical pressure; but being sensible that mere conjecture, however plausible it may appear, is the bane of natural history, I resolved to investigate the subject experimentally. Having obtained spiders of the above named species, in various stages of growth, I found that the larger individuals experienced greater difficulty in ascending glass than the smaller ones, which, in numerous instances, were capable of moving on an ordinary window-pane, even in an inverted position, or with the back downwards. It was evident also, that physical energy (other conditions being the same) gave its possessor a decided advantage in this respect. When highly polished glass of a superior quality was employed, the difficulty was increased; and, in all cases, those spiders effected an ascent with the greatest effort, which, in proportion to their bulk, had the inferior surface of their tarsi most sparingly furnished with the requisite apparatus. These results, some of which are in direct opposition to the hypothesis I had previously entertained, determined me to inspect the tarsal appendages more minutely than I had hitherto done; and a peculiarly favourable opportunity unexpectedly presented itself. Three living specimens of *Mygale avicularia* having been brought accidentally to Manchester, in dye-woods imported from the West India Islands during the year 1830, I availed myself of the circumstance, to examine under the microscope the appendages with which the tarsi of that gigantic species are so abundantly supplied; conceiving that their structure would be exhibited to greater advantage in a recent subject, than in individuals which have long occupied a place in the cabinet. In this expectation I was not disappointed; and I shall now proceed to describe the organization of the appendages, which is much more complex than I had anticipated.—Each consists of a slender bristle fringed on the sides with exceedingly fine hairs gradually diminishing in length as they approach its extremity, where they occur in such profusion as to form a thick brush on its inferior surface, giving the part that dilated appearance already alluded to. This structure, as far as my researches extend, is common to the tarsal appendages of those spiders which are able to ascend the perpendicular sides of smooth bodies without supervenient aid; and the minute bristles with which the tarsal cushions of many insects, remarkable for their ability to walk up glass, are furnished, appear to possess an organization closely analogous.

The hold upon objects which the setaceous bristles give to the spiders provided with them, depending, in a great measure, on the numerous points of contact they present, seems to be purely mechanical; nevertheless, it has been shown by experiment, (see p. 224-25,) that their efficiency in this respect must be attributed, principally, to a viscous secretion which they emit. At a very low estimate, there are on the slender bristles which form the brushes occurring on the inferior part of the tarsi, and the terminal joint of the pediform palpi of adult females of the species *Mygale avicularia*, more than 6,000,000 hairs of extreme delicacy, a large proportion of which can be applied by the spider to bodies with plain surfaces. If the finger be drawn gently along the under side of the tarsi, from their extremities towards the tibiæ, they will be found, even in dried specimens, to adhere powerfully to the cuticle; the sensation occasioned by this proceeding exciting in the mind the idea that they are smeared with some viscous matter. At Plate 1, a setaceous bristle from one of the tarsi of *Mygale avicularia* is represented by fig. 4; and one of the compound hairs which clothe the limbs of *Aranea civilis* by fig. 5. It is almost unnecessary to offer any caution against confounding objects so essentially distinct.

Dr. Leach, in treating upon spiders in the article *Annulosa*, published in the *Supplement to the Encyclopædia Britannica*, p. 435, remarks, that "when about to cast their covering, they suspend themselves in some corner, and creep out of a crack which takes place on their back, gradually withdrawing their legs from the skin, as if from a glove." With deference to so accomplished a zoologist, I may be allowed to observe, that this statement is not in strict accordance with my own experience; and as I do not remember to have met with a satisfactory account of the moulting of spiders, in the course of my reading, I shall endeavour to elucidate this curious subject, by giving such particulars relative to it as have fallen under my notice.

Considering the apparent uniformity of the process by which this important change in the external condition of spiders is effected, it will suffice to detail the proceedings of a single species; and as *Epeira calophylla* is of frequent occurrence about retired buildings situated in the country, and, consequently, may be procured without difficulty, I shall select it for the purpose. Preparatory to casting its integuments, this spider spins several strong lines in the vicinity of its snare, from which it suspends itself by the feet and a filament proceeding from the spinners. After remaining for a short time in this situation, the corneous covering of the cephalothorax gives way,—not in the medial line of the dorsal region, as Dr. Leach's statement would seem to imply, but laterally, disuniting immediately above the insertion of the mandibles and legs, so that the head and thorax are the first parts liberated. The line of separation pursues the same direction till it extends to the abdomen, which is next disengaged; the extrication of the legs being the last and greatest difficulty which the spider as to overcome. As the suspensory filament connected with the spinners of the exuviæ is considerably shorter than the legs, and does not undergo any sensible alteration in length, the abdomen, during the process of moulting, becomes gradually deflected from its original horizontal direction, till it assumes a vertical position, nearly at right angles with the cephalothorax. By this change of posture, attended with numerous contortions of the body, and alternate contractions and extensions of the limbs, the spider is ultimately enabled to accomplish its purpose. The spines with which the legs are provided no doubt contribute to facilitate the operation greatly; for, as they are directed down the limbs, and are moveable at the will of the animal, when it has partially withdrawn the legs from their sheaths by contracting them, it can prevent them from re-entering by slightly erecting the spines, and thus bringing their extremities in contact with the inner surface of the integuments. When the spider has completely disengaged itself from the slough, it remains, for a short period, in a state of great exhaustion, suspended solely by a thread from the spinners, connected with the interior of the abdominal portion of the cast skin, which is much corrugated and drawn together. The entire process, as above described, occupies the space of about twenty minutes. After reposing a little, the spider further attaches itself to the suspensory lines by the claws of the feet; and when its strength is sufficiently restored, and its limbs have acquired the requisite degree of firmness, it ascends its filaments and seeks its retreat.

Having frequently witnessed the moulting of spiders in their natural haunts, and also in a state of captivity, and having carefully examined the cast skins of numerous species belonging to the genera *Dysdera*, *Segestria*, *Clubiona*, *Drassus*, *Aranea*, *Textrix*, *Theridion*, *Neriene*, *Manduculus*, *Linyphia*, *Epeira*, *Thomisus*, *Dolomedes*, *Lycosa*, *Hecaërge*, *Salticus*, *&c.*, in the precise situations, and under the same circumstances, apparently, in which they have been left by their former occupiers, I am thoroughly persuaded that the process is a very uniform one.

Intimately connected with the renovation of the integuments is the reproduction of the limbs of spiders. For this interesting discovery we are indebted to the late Dr. C. Heineken, whose investigations relative to the subject are published in the *Zoological Journal*, vol. IV. p. 284 & 422; and I am happy to bear testimony to the general accuracy of his conclusions.

The reproduction of the palpi does not appear to have been noticed by Dr. Heineken; but that those members, after suffering mutilation, are restored in the same manner as the legs, I have clearly proved by repeated experiments. That mutilated members are not always reproduced at a subsequent moulting, even when it takes place at a period considerably after the infliction of the injury, is rendered evident by the following remarkable fact. On the 13th of July, 1830, a male specimen of *Clubiona atrox* had the palpus and the second leg on the right side divided, the former near its base, the latter about the middle of the femur, and on the 15th of the succeeding month it cast its skin; yet, though all the other limbs were renewed, the stumps only of the mutilated members were reproduced. In cases in which spiders spontaneously throw off their legs at the suture, or have them partially removed by amputation, it would be desirable to ascertain in what state the rudiments of the limbs to be reproduced exist just previously to the act of moulting, as there is something mysterious in their extraordinary development during that process.

For some years past I have been engaged, occasionally, in conducting experiments having for their object the determination of a highly interesting question in physiology; namely, what are the true nature and functions of the remarkable organs connected with the fifth or terminal joint of the palpi of male spiders? The opinion advanced by

M. Treviranus, and adopted by M. Savigny, that those parts are instruments employed for the purpose of excitation merely, preparatory to the actual union of the sexes by means of appropriate organs situated near the anterior extremity of the inferior region of the abdomen, is in direct opposition to the views of Dr. Lister, and the earlier systematic writers on arachnology, who regarded them as strictly sexual; and the results of my own researches, which I shall proceed to detail, clearly demonstrate the accuracy of the conclusions arrived at by our celebrated countryman.

In the spring of 1831, I procured young female spiders of the following species, *Epeira Diadema*, *Epeira apoclisa*, *Epeira calophylla*, *Epeira cucurbitina*, *Theridion nervosum*, *Theridion denticulatum*, *Agelena labyrinthica*, *&c.*, and having placed them in glass jars, I fed them with insects till they had completed their moulting and attained maturity, which is easily ascertained, in most instances, by the perfect development of the sexual organs. I then introduced to them adult males, taking care to remove the latter as soon as a connexion had been consummated in the usual manner, by the application of the palpal apparatus to the orifice situated between the plates of the spiracles in the females. I never, in a single instance, suffered the sexes to remain together any longer than I found it convenient to continue my observations, and I may remark, that their union, however prolonged and undisturbed, was invariably accomplished in the manner stated above, without the slightest deviation being perceptible on the most minute inspection. After a lapse of several weeks, the females, thus impregnated, respectively fabricated their cocoons and deposited their eggs in them, all of which proved to be prolific; affording a complete refutation of the opinion promulgated by M. Treviranus.

Having repeated this experiment with numerous species of spiders, and the results obtained being uniformly the same, there did not appear to be any necessity for pursuing the investigation further; nevertheless, that there might not remain the slightest doubt on the mind of the most fastidious inquirer, in the summer of 1832, I brought up from the egg young females of the species *Epeira calophylla*, and *Epeira cucurbitina;* which, when they had arrived at maturity, I treated in the manner described in the preceding cases. In the autumn of the same year these spiders deposited their eggs in cocoons spun for their reception, out of which the young issued in the ensuing spring, having undergone their first moult in the cocoons.

These experiments, besides effecting the purpose for which they were instituted, served also to supply collateral evidence of the correctness of M. Audebert's observations relative to the capability of the House-spider, *Aranea domestica,* to produce several sets of prolific eggs in succession, without renewing its intercourse with the male; for three females of the species *Agelena labyrinthica* deposited each a second set of eggs, and a female *Epeira cucurbitina* laid four consecutive sets, intervals of fifteen or sixteen days intervening, all of which produced young, though these females had not associated with males of their species for a considerable period antecedent to the deposition of the first set of eggs.

M M. Lyonnet and Treviranus, with other skilful zootomists, have fallen into the error of mistaking the superior spinning mammulæ of spiders, when triarticulate and considerably elongated, for anal palpi; (palpes de l' anus;) denying that they perform the office of spinners, in consequence of their having failed to detect the papillæ from which the silk proceeds; and in this opinion they are followed by the most distinguished arachnologists of the present day. I am inclined to attribute this singular oversight to the peculiar disposition and structure which the papillæ or spinning tubes connected with the superior mammulæ, when greatly elongated, frequently exhibit. Arranged along the under side of the terminal joint, they present the appearance of fine hairs projecting from it at right angles; but if the spinners, when they are in operation, be carefully examined with a powerful magnifier, the function of the hair-like tubes may be ascertained without difficulty, as the fine lines of silk proceeding from them will be distinctly perceived.

In conducting this observation I usually employ the *Agelena labyrinthica* of M. Walckenaër; partly because I can procure specimens with facility; but chiefly on account of its size, the length of its superior mammulæ, and its habits of industry, affording a combination of advantages comprised by no other British Spider.

The purpose subserved by the superior mammulæ, when very prominent and composed of several joints, is the binding down with transverse lines, distributed by means of an extensive lateral motion, the threads emitted from the inferior mammulæ; by which process a compact tissue is speedily fabricated.

The foregoing facts supply a striking exemplification of the importance of connecting physiological investigations with anatomical details.

In attempting to drown a small spider, new to naturalists, which I have named *Erigone atra,* for the purpose of taking its dimensions accurately by measurement, I was astonished to find, that at the expiration of two days, though it had remained under water the whole of the time, it was as lively and vigorous as ever. This extraordinary circumstance induced me to submerge numerous specimens, of both sexes, in cold water contained in a glass vessel with perpendicular sides, on the 21st of October, 1832, in which situation they continued till the 22nd of November, an interval of 768 hours, without having their vital energies suspended.

This experiment I have tried with individuals of other species, and some of them have preserved an active state of existence for six, fourteen, or twenty-eight days, spinning their lines and exercising their functions as if in air; while others have not survived for a single hour. It is evident, therefore, from these curious facts, that some spiders possess the power of abstracting respirable air from water; for though, in the act of submersion, the spiracles are usually enveloped in a bubble of air, yet so small a supply is speedily exhausted, and, indeed, soon disappears.

The external and internal organization of such species of *Araneidæ* as can exist for a long period of time under water deserves to be attentively examined; but those species which I have observed hitherto are minute, and it would require the hand and eye of an accomplished anatomist, assisted by the most delicate instruments and powerful magnifiers, to effect this desirable object satisfactorily.

Instances of long sustained abstinence from food by animals of the family *Araneidæ*, unaccompanied by any manifest diminution of vital energy, have been recorded by various naturalists, and many more might easily be added to the catalogue; I shall limit myself, however, on the present occasion, to the narration of a very remarkable case, in illustration of this fact, which came under my own immediate observation.

A female *Theridion quadripunctatum*, captured in the month of August, 1829, was placed in a phial of transparent glass, and fed with flies till the 15th of October, in the same year, during which interval she accomplished her final moult, and attained maturity. She was then removed to a smaller phial, which was closely corked and locked up in a book-case, her supply of food being at the same time discontinued. In this phial she remained till the 30th of April, 1831, on which day she died, without receiving the slightest nourishment of any description; yet, till the autumn of 1830, no apparent change had taken place either as regards her external appearance or physical energy. Throughout the entire period of her captivity, she never failed to produce a new snare when the old one was removed, which was frequently the case; and it is particularly deserving of attention, that the alvine evacuations were continued, in minute quantities and at very distant intervals, to the termination of her existence.

In publishing cases similar to that just detailed, it is desirable that dates should always be given; for spiders, during the winter months, remain in a state of inactivity, their vital functions becoming feeble under the benumbing influence of cold, consequently, until they are invigorated by an increase of temperature, a supply of nutriment is not required.

CHARACTERS OF SOME

UNDESCRIBED GENERA AND SPECIES

OF

ARANEIDÆ.

Tribe......*Territelæ*......Latreille.
Genus ....*Mygale* ....Walckenaër.
Mygale elegans.

THE male of this fine species is unknown to me. The cephalothorax of the female is large, somewhat oval, notched behind, broadly rounded before, and convex above, with an indentation in the medial line of the posterior region; its colour is very dark brown, with reddish margins. The eyes, which in dead specimens have red irides, are grouped on a small, frontal eminence; three on each side, of an oval shape, form an irregular triangle, whose apex is directed forwards; and the other two, which are the largest of the eight, and circular, are situated on a transverse line between the preceding groups: the intermediate eyes of the four constituting the bases of the triangles are much smaller than the rest. The mandibles are very powerful, articulated horizontally, prominent, and greatly curved; they are provided with three longitudinal bands of short, fine hair or down on the upper side, the intervals, where the surface is exposed, being black and glabrous; the superior band is of a brown colour; it is interspersed with numerous long, black hairs, and is much broader than the two exterior bands, which are brown, tinged with pale red. Each mandible is terminated by a large, curved, acute, black nail bent underneath; a longitudinal row of teeth, and a dense fringe of long, red hair occupying its under side. The lip is small and quadrate. The maxillæ are strong, divergent, and densely fringed with long, red hairs on the inner margin, which is elongated into a pointed protuberance before. These organs are of a dark red-brown colour, the apex of the lip being the palest. The pectus is quadrilateral, longer than broad, and of a dark brown colour, approaching to black. The legs are long and robust, tapering to the extremity of the tarsi, which are furnished with a dense brush on the under side, and are terminated by two claws, toothed at the base; the first pair is the longest, then the fourth, the third pair being the shortest; their general colour is very dark brown, some narrow, longitudinal spaces, devoid of hair, giving them a striped appearance on the upper side, when closely inspected; the anterior part of the coxæ, and the trochanters, are clad with pale red hair above; the joints are reddish beneath, and the tibiæ and tarsi are armed with black sessile spines. The palpi, which are long and pediform, are inserted at the anterior extremity of the maxillæ; their terminal joint has a plain claw at its extremity, and a dense brush underneath; they resemble the legs in colour, and are provided with sessile spines. The abdomen is oval, dark brown above, intersected by six or seven curved bands of a pale red colour; several of the anterior bands have their continuity slightly interrupted in the medial line, but the posterior ones preserve theirs entire; the colour of the under side is very dark brown, with the exception of the lips of the four spiracles, which are reddish. At the posterior extremity of the abdomen are four spinning mammulæ; the two superior ones are very long and prominent, each consisting of three joints, and the two inferior ones are small; on the former, the papillæ or spinning tubes are arranged along the under side of the terminal joint.

Length, from the most prominent part of the mandibles to the extremity of the abdomen, not including the spinners, 1 inch and $\frac{17}{20}$ths; length, from the anterior margin of the cephalothorax to the extremity of the abdomen, $1\frac{13}{20}$; length of the cephalothorax $\frac{17}{20}$; breadth $\frac{7}{10}$; length of an anterior leg $3\frac{1}{5}$; length of a posterior leg $3\frac{1}{10}$; length of the nails at the extremity of the mandibles, following their curve, $\frac{2}{5}$; length of a superior spinning mammula $\frac{1}{2}$.

Specimens of this spider are deposited in the Museum belonging to the Society for the promotion of Natural History, established in Manchester, but I am not able to state in what quarter of the globe they were procured.

Genus......*Cteniza*......Latreille.
Cteniza spinosa.

The Manchester Museum contains a specimen of a female spider, belonging to the genus *Cteniza*, which does not appear to coincide with any species given by M. Latreille, under the head "*Mygale,*" in the second edition of the *Nouveau Dictionnaire d' Histoire Naturelle;* I have ventured therefore to describe it as new to arachnologists.

The cephalothorax is of an irregular oval figure, convex above and glossy, with an indented, curved line, whose convexity is directed towards the abdomen, occupying its posterior region. The eight eyes are seated on a small, frontal eminence, and, in dead specimens, are of a yellow hue; three on each side, of an oval shape, form an irregular triangle, whose apex is directed forwards, the two anterior ones being the largest of the eight; and the other two, which are circular, are situated on a transverse line between the preceding groups. The mandibles are very powerful, articulated horizontally, prominent, and curved; they have a bold projection on the upper side of their anterior extremity, just above the insertion of the nail, which is furnished with numerous short, acute, black spines; and their inferior surface is armed with two longitudinal rows of teeth, the interval between them being occupied by the strong, black nail, when in a state of repose. The maxillæ are robust, divergent, densely fringed with long, red hairs on the inner margin, and are provided with small, sharp, black spines underneath. The lip, which is quadrate, has some minute, black spines at its apex. The pectus is nearly circular, and glabrous. The legs are short, powerful, and provided with long hairs, particularly on the under side; the fourth pair is the longest, then the first, the third pair being a little shorter than the second. The thighs of the first and second pairs are compressed and slightly curved, the second or anterior joint of the tibiæ, and the two tarsal joints being armed on the sides with numerous short, strong, acute, black spines, curving downwards at their extremities, like small claws; the second joint of the tibiæ of the third pair of legs is greatly depressed on the upper side, its anterior extremity, and that of the epicnemis or first joint of the tibiæ, which are prominent, together with the tarsal joints, are furnished with numerous short, strong, black spines on their superior surface; the tibiæ of the posterior legs are destitute of spines, but the tarsi have some minute, black ones on their exterior side; and the terminal joint has a longitudinal row of long, closely set, slender spines or bristles on the inferior part of its inner surface. Each tarsus is terminated by three black claws; the two superior ones are much curved, (the one on the anterior side being the larger,) and have a single, large tooth near the base; the inferior claw is small and bent abruptly downwards. The palpi, which are long and pediform, are inserted at the anterior extremity of the maxillæ; the second joint is greatly compressed, and curved; the ultimate and penultimate joints are supplied with numerous short, strong, black spines on their sides, the former having a large, black claw, at its termination, which is provided with a solitary tooth near its base. All these parts, with the preceding exceptions, are of a deep red-brown colour, the mandibles and the depressed part of the tibiæ of the third pair of legs being the darkest. The abdomen is somewhat oval, and of a yellowish brown colour; its posterior extremity presents four spinning mammulæ; the two superior ones are robust, and prominent, each consisting of three joints; and the two inferior ones are minute. In this species the papillæ from which the silk issues occupy a circular space at the extremity of each mammula.

Length, from the most prominent part of the mandibles to the extremity of the abdomen, not including the spinners, 1 inch and $\frac{3}{20}$ths; length, from the anterior margin of the cephalothorax to the extremity of the abdomen, $1\frac{1}{20}$; length of the cephalothorax $\frac{1}{2}$; breadth $\frac{2}{5}$; length of a posterior leg $1\frac{3}{20}$; length of a leg of the third pair $\frac{9}{10}$; length of a superior spinning mammula $\frac{1}{8}$.

Tribe......*Tubitelæ*......Latreille.
Genus......*Savignia.*

Eyes six in number, unequal in size; four of them, which are disposed in a transverse row behind the anterior prominence of the cephalothorax, are separated by large intervals, the two intermediate ones being the smallest of the six; and immediately before each of the lateral eyes another is situated.

Maxillæ greatly enlarged at the base, externally, where the palpi are inserted, and inclined towards the lip, which they encompass.

Lip short, broad, prominent at the apex, and semicircular.

Legs moderately robust; the anterior and posterior pairs, which are the longest, equal in length; the third pair is the shortest.

The name of M. Savigny, which I have bestowed upon this genus, is connected with highly interesting discoveries in this department of zoology.

Savignia frontata.

(Plate 2, fig. 1 and 2.)

The cephalothorax is oval, convex above, with a minute indentation in the medial line of the posterior region, and an acute eminence, of a conical form, in front, surmounted by a tuft of fine hair. The mandibles are small, dentated on the inner side, and inclined towards the pectus, which is heart-shaped. These parts, with the maxillæ and lip, are of a dull brownish black colour. The colour of the legs and palpi is brown, with a tinge of red. Each tarsus has three claws at its extremity; the two upper ones are finely pectinated, and the inferior one is abruptly inflected near its base. The fourth and fifth joints of the palpi are expanded laterally; the former projects an apophysis in front, tapering into an acute point, curved outwards; both are convex and hairy externally, concave within, and are connected with the palpal or sexual organs, which are highly developed, complicated in structure, and of a very dark red-brown colour. The abdomen is oval, rather convex above, projecting over the base of the cephalothorax; it is sparingly clad with hair, glossy, and black.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{12}$th of an inch; breadth of the cephalothorax, which equals that of the abdomen, $\frac{1}{28}$; length of a fore leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{12}$.

The above is the description of a male, which sex is found in considerable abundance, in the months of October and November, on rails, in the immediate vicinity of Crumpsall Hall, near Manchester. I have not yet succeeded in capturing a single female; and, concerning the economy of the animal, I can merely state that it is active during the day, and can exist for many hours immersed in water.

The short and broad lip; the converging maxillæ; the large intervals between the eyes; (those of the lateral pairs excepted;) and the difference in the relative length of the legs; at once distinguish this spider from the species constituting the genus *Dysdera*, to which it is nearly allied.

Genus......... *Walckenaëria.*

Eyes eight in number, unequal in size, disposed in pairs on the anterior eminence of the cephalothorax, which is elongated and acute. One pair is seated on its summit; a second a little lower, in front, describing with the former a trapezoid whose anterior side is the shortest; and the two other pairs are placed obliquely, one on each side of the frontal eminence. The eyes of the lateral pairs, which are geminated, are the largest, and those of the anterior pair are the smallest of the eight.

Maxillæ strong, convex externally, greatly dilated at the base, where the palpi are inserted, encompassing the lip.

Lip short, broad, prominent at the apex, and semicircular.

Legs robust; the anterior and posterior pairs, which are the longest, equal in length, in the females; the third pair is the shortest.

I have conferred upon this singular genus the name of a distinguished living arachnologist, the celebrated Baron Walckenaër.

Walckenaëria acuminata.

(PLATE 2, fig. 3, 4, 5, 6.)

The cephalothorax is oval, gibbous above, with a minute indentation in the medial line of the posterior region, and terminates in an acute prominence before. The pectus is oblong heart-shaped. The mandibles are vertical, moderately strong, convex in front, and dentated on the inner side. These parts, with the maxillæ and lip, are glossy, and of a dark brownish black colour. The palpi are robust, and without claws; the third joint is remarkably short, and the fourth and fifth joints are somewhat dilated. The legs are hairy, but destitute of spines.

Each tarsus has three claws at its extremity; the two superior ones are strongly pectinated, and the inferior one is abruptly inflected near its base. The colour of these organs is bright rufous. The abdomen is oval, rather convex above, projecting a little over the base of the cephalothorax; it is sparingly clad with hair, glossy, and deep black. The plates of the spiracles are of a pale yellow colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{13}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{15}$; length of a fore leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{6}$.

Rather smaller than the female, but similar to her in colour, and in the relative length of its legs, the male has the anterior part of the cepnalothorax much more elongated and slender, measuring about $\frac{1}{20}$th of an inch in length; it is elevated vertically, and dilated near the middle, and at the apex; the latter dilatation being separated, by a transverse groove, into an upper and a lower segment, both of which are rough with short, strong hairs. On these enlargements the eyes are situated. The third joint of the palpi expands gradually towards its anterior extremity; the fourth joint is short, terminating in three apophyses, and on the upper part of the inner apophysis, which is longer than either the exterior or inferior one, and is curved outwards, a small prominence occurs; the fifth or terminal joint is somewhat oval, convex and hairy externally, concave within, comprising the palpal organs, which are black, with a tinge of red; they are highly developed, and complicated in structure, having a strong spiny process on the outer side, curved into a circular form.

My brother, Mr. Thomas Blackwall, discovered this remarkable spider, in the month of October, 1832, under stones and on rails, in the township of Crumpsall, near Manchester.

Walckenaëria cristata.

(PLATE 2, fig. 7, 8, 9, 10.)

In colour this species is similar to *Walckenaëria acuminata*, with the exception of the legs, which have a deeper shade of rufous; but in external structure it presents several obvious points of difference. The anterior part of the cephalothorax is less elevated and acute, and the pectus is shorter and broader proportionally.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{11}$th of an inch; length of the cephalothorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of the abdomen $\frac{1}{24}$. The fore and hind legs, which are the longest, and equal in length, measure $\frac{1}{10}$th; and the legs of the third pair, which are the shortest, $\frac{1}{11}$th.

The relative length of the legs is different in the sexes; the male has the fourth pair the longest, measuring $\frac{1}{8}$th of an inch, then the first, the third pair being the shortest. The anterior eminence of the cephalothorax is shorter and very much stronger than the same part in the male of *Walckenaëria acuminata;* it is divided into two segments, at the summit, by a deep, transverse groove; and each is surmounted by a tuft of fine hair, inclined towards the groove, and forming a crest. One pair of eyes is seated on the hinder part of the posterior division of the eminence, near its summit, and another pair is situated near the summit of the anterior division, in front, describing with the former a long trapezoid, whose shortest side is before; the other eyes are disposed in pairs, one on each side of the frontal prominence, and are geminated. The eyes of the lateral pairs are the largest, and those of the anterior pair the smallest of the eight. The third joint of the palpi is enlarged at its anterior extremity; the fourth presents two apophyses; one small, projecting underneath; the other, which is much larger, and terminates in a point, curved outwards, being situated in front; the fifth joint, and the anterior apophysis of the fourth are expanded laterally; they are convex and hairy externally, concave within, and are connected with the palpal organs, which are highly developed, exhibiting several curved, spiny processes, (a certain indication that the animal has attained maturity,) and are of a dark red-brown colour.

Mr. T. Blackwall discovered this minute species, in October, 1832. It is found in abundance under stones, and on rails, in the townships of Cheetham and Crumpsall, near Manchester.

Walckenaëria cuspidata.
(Plate 2, fig. 11.)

This species is precisely similar in colour to *Walckenaëria acuminata*, but in the form of the pectus it resembles *Walckenaëria cristata*. The upper part of the cephalothorax is not so gibbous as that of the other species belonging to the genus, and has no indentation in the medial line of the posterior region.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{26}$; breadth of the abdomen $\frac{1}{22}$. The legs of the first and last pairs, which are the longest, and equal in length, measure $\frac{1}{7}$th; and those of the third pair, which are the shortest, $\frac{1}{9}$th.

The male is rather smaller than the female, but the relative length of its legs is the same. In the trapezoid formed by the four intermediate eyes, immediately in front of the posterior pair, it has a small, conical, acute prominence, surmounted by a few fine hairs. The fourth joint of the palpi terminates in two apophyses, the smaller one projecting on the under side; the longer has a prominence at its exterior part, near the base, and curves outwards, in front of the fifth joint, which is somewhat oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, and complicated in structure, with a strong spine externally, curved into a circular form.

This spider occurs on rails, in the vicinity of Manchester, in the month of November.

Walckenaëria obscura.

I have discovered the male only of this minute species, which bears a close resemblance to the male of *Walckenaëria cristata*, but may readily be distinguished from it by the anterior and posterior pairs of legs being equal in length, and by the structure of the palpi. The third and fourth joints of the latter organs are short; the fourth is the stronger and has two small apophyses at the anterior extremity, one situated in front, the other on the outer side; the fifth joint is somewhat oval, convex and hairy externally, with a bold, conical protuberance in the middle; it is concave within, comprising the palpal organs, which are highly developed, and complicated in structure, having a short, curved spine on the outer side of the upper part, and a long, filiform one underneath, which curves downwards to the lower extremity, where there is a pointed spine, curved outwards; they are of a red-brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{14}$th of an inch; length of the cephalothorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of the abdomen $\frac{1}{30}$; length of an anterior leg $\frac{1}{11}$; length of a leg of the third pair $\frac{1}{14}$.

A few specimens of this spider were found on iron rails at Crumpsall Hall, in the month of April, 1834.

Walckenaëria flavipes.

The male of this diminutive species differs from the male of *Walckenaëria cristata* in having the first and last pairs of legs of an equal length, and in the structure of the palpi; in this latter circumstance, and in the colour of the limbs, which are of a dull yellow hue, it differs from the male of *Walckenaëria obscura* also; in other particulars it resembles both those spiders. The third joint of the palpi is short; the fourth is long, and tapers to the extremity, which is greatly curved outwards, in front of the fifth; this last joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, and complicated in structure, having a small, curved spine on the outer side of the upper part, another, nearly straight, projecting in front from within the curvature of the fourth joint, and a third, almost describing a circle, situated at the anterior extremity; their colour is red-brown.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{14}$th of an inch; length of the cephalothorax $\frac{1}{28}$; breadth $\frac{1}{36}$; breadth of the abdomen $\frac{1}{34}$; length of an anterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{13}$.

I captured the specimen, from which the above description was taken, under the exfoliating bark of a sycamore at Crumpsall Hall, in the month of May, 1834.

By the pointed form of the anterior part of the cephalothorax; the converging maxillæ; and the structure of the legs; the spiders of this genus are connected with the *Drassi*;

but they differ from them essentially in the disposition and relative size of the eyes, and in the figure of the lip; in which particulars they approach more nearly to the *Linyphiæ* and *Theridia*.

Genus........*Erigone*........Savigny.

Erigone atra.

The cephalothorax is inversely heart-shaped, with an indentation in the medial line of the posterior region, and is very prominent before. The mandibles are powerful, rather convex in front, strongly toothed on the inner surface, and slightly inclined towards the pectus, which is heart-shaped. The maxillæ are greatly enlarged at the base, externally, where the palpi are inserted, and encompass the lip, which is short and semicircular. The fourth pair of legs is the longest, then the first, the third pair being the shortest. At the extremity of each tarsus there are three claws; the lower one is abruptly inflected near its base, and each of the others has a row of short teeth, extending from its articulation with the tarsus about two-thirds of its length, the terminal one being the longest. The eyes are disposed in two transverse rows on the summit of the anterior convexity of the cephalothorax; the intermediate ones of both rows form a square, and the other four are placed obliquely in pairs, one on each side of the square. The abdomen is oval, convex above, projecting over the base of the cephalothorax. This spider is sparingly clad with hair, and is glossy black, with the exception of the legs and palpi, which, in adults, are of a reddish brown colour, and the plates of the spiracles, which are yellow.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{9}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{20}$; length of a posterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{9}$.

The male differs from the female in several remarkable particulars: it is smaller; the lateral margins of the cephalothorax are strongly dentated; and a series of short, sharp spines, slightly curved forwards, occupies the medial line of its anterior convexity. Each mandible, also, has a longitudinal row of spines, curved downwards, on its exterior side. (Small spines occur on the mandibles of old females.) The second joint of the palpi is greatly elongated, much curved, and is armed with strong spines beneath; the third and fourth joints are dilated at their anterior extremities, the former having a large, conical apophysis on the lower side, and the latter two terminal apophyses; one short and broad, projecting in front; the other more elongated and acute, situated underneath; the fifth joint is in the form of a long oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, and of a very dark red-brown colour. The relative length of the legs, likewise, is different in this sex; the first pair is the longest, measuring $\frac{1}{7}$th of an inch, and the fourth, second, and third pairs decrease successively in longitudinal extent. These organs, and the palpi, are much redder than those of the female. A complete investigation of the external organization cannot be effected without the assistance of a good microscope.

Independently of colour, the spider described above may be distinguished by its external structure from the *Erigone vagans* of M. Savigny. (*Description de l'Égypte.*

Seconde édition, tome XXII, *p.* 319-321. *Atlas de Zool., Arachn., pl.* 1, *fig.* 9.) The male of the latter species has three rows of spines on the anterior convexity of the cephalothorax, a single row on the under part of each thigh of the first pair of legs, and the second pair of legs is longer than the fourth ; whereas, the new spider has only one row of spines in the former situation, and none in the latter ; a few very minute ones, merely, occuring on the inner side of the thighs of the fore legs, near their base ; and the fourth pair of legs is longer than the second ; moreover, each palpus of the female of *Erigone vagans* has a pectinated claw at its extremity, but the palpi of *Erigone atra* are entirely destitute of claws.

This diminutive spider is very plentiful, and decidedly diurnal. Endowed with an instinctive impulse to ascend into the atmosphere, it frequently takes aërial excursions, and is active, even in winter, when the weather is mild. In all probability it has, hitherto, been mistaken for the immature offspring of other species. It pairs in June, and deposits its eggs, which are large in proportion to the size of the animal, six or seven in number, spherical, not agglutinated together, and of a pale yellowish white colour, in a cocoon of white silk, of a slight texture and subglobose form, whose greatest diameter measures about $\frac{1}{10}$th of an inch; it is usually placed under stones and in crevices of the earth. The young, after the first moult, are of a dark dull brown colour. I have already adverted to the power which this species possesses of existing for a long period of time under water. *See p.* 300-1.

Genus......*Drassus*......Walckenaër.

Drassus nitens.

This handsome species has the cephalothorax of an oval form, convex above, somewhat rounded in front, and thinly covered with short, hoary hairs, which are most abundant on the anterior part; its colour is brownish black, with six faint, white lines, three on each side, diverging from the superior part to the lateral margins. The eyes are eight in number, disposed on the anterior part of the cephalothorax in two transverse, curved, concentric rows, whose convexity is directed backwards; the interval between the intermediate eyes of the posterior row is greater than the space which separates them from the lateral eyes of the same row, and the intermediate eyes of the anterior row are the smallest of the eight. The mandibles are strong, conical, perpendicular, with a curved, red nail at the extremity, and a very few exceedingly minute teeth on the inner surface. The maxillæ are powerful, enlarged externally, where the palpi are inserted, greatly dilated at the base, beneath, compressed near the middle, slightly enlarged, and rounded at the extremities, and inclined towards the lip. The lip is longer than broad, and round at the apex. The pectus is of an oblong oval figure, pointed at the posterior extremity. These parts are of a brown-black colour, the pectus being the darkest. The legs are long, and their colour is brown, with a faint tinge of red, the coxæ, trochanters, and thighs of the first pair, and the trochanters and thighs of the second pair excepted, which are of a dark brownish black hue; the thighs of the anterior legs are robust. Two plain, curved claws terminate each tarsus, and underneath them is a small brush; some compound, hair-like tubes, or papillæ, for the emission of a viscous secretion, similar in structure to those constituting the brushes, occur on the under side of the tarsi. The palpi are filiform; the first and second joints are dark brownish black; the third, fourth, and fifth joints being of the same colour as the tibiæ and tarsi. The abdomen is in the form of an elongated oval, projecting a little over the base of the cephalothorax, and is covered with short hairs; it is deep black; but, when seen in a powerful light, reflects rich tints of purple, green, and copper; on the upper part, in front, is a small, transverse, slightly curved, white line, whose convexity is directed forwards; and behind it, but at a considerable distance, is a long, transverse, white line, the middle part of which is abruptly curved in a direction opposed to that of the anterior one; nearly opposite to each extremity of the longer line is a detached white spot, on the sides of the abdomen, and a short, white line extends obliquely above the outer margin of each plate of the spiracles; along the medial line of the upper part of the abdomen is a row of small, white spots; the one on the coccyx, which terminates the series, being the most conspicuous. The spinning mammulæ are cylindrical, and rather prominent. Some slight modifications of form and size may be perceived, occasionally, in the white lines and spots, so remarkable on this species.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{14}$; length of a posterior leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{7}$.

The male, though less than the female, resembles it in colour, and in the relative length of its legs; but their absolute length is rather greater, a posterior one measuring $\frac{9}{40}$ths of an inch. The third and fourth joints of the palpi are short, the latter projecting a small, pointed apophysis from the outer side of its anterior extremity; the fifth joint is of an elongated oval shape, pointed before; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, with a small, prominent, curved spine beneath, and are of a red-brown colour.

I discovered this small but brilliant spider, in April, 1833, among moss, in the woods about Oakland, in Denbighshire. It belongs to M. Walckenaër's third section of the genus *Drassus*, or the *Peritæ*, having a close affinity with *Drassus fulgens*. Like some other species of *Araneidæ*, it is partial to moisture, and drinks water freely. A pair, which I had confined in a glass phial, having become feeble, and greatly shrunk, I introduced to them a few drops of water, which they drank of with avidity, and speedily resumed their strength, and former plump appearance. In the month of May, females of this species, in a state of captivity, constructed cocoons of a hemispherical form, in which they deposited nine or ten globular eggs of a pale yellow colour, not agglutinated together. The cocoons were composed of delicately white silk of a very fine, compact texture, and above each was fabricated an open tube of the same material, which was usually occupied by the spider.

Drassus saxatilis.

This fine species has the cephalothorax large, glossy, convex above, depressed and broadly truncated before; the sides, which are somewhat depressed, are marked with slight furrows, extending from the superior part to the lateral margins, and a narrow, elongated indentation occurs in the medial line of the posterior region. The eyes are eight in number, disposed in two transverse, parallel rows on the anterior part of the cephalothorax; the intermediate eyes of the anterior row, which is the shorter of the two, and situated immediately above the frontal margin, are the smallest of all; and the lateral eyes of each row are seated on tubercles, united at their bases. The mandibles are very powerful, vertical, triangular, exceedingly prominent at the base, and provided with two rows of teeth, and a dense fringe of hair, on the inner side. The maxillæ are robust, curved towards the lip, enlarged at the base, externally, where the palpi are inserted, and also at the extremities, which are obliquely truncated on the inner side, and fringed with hair. The lip is longer than broad and truncated at the apex. The pectus is heart-shaped, inclined to oval, and glossy. The legs and palpi are strong, hairy, and provided with spines; the latter being terminated by a pectinated claw. The last pair of legs is the longest, then the first, and the third pair is the shortest. Each tarsus has three claws at its extremity; the two superior ones are deeply pectinated, and the inferior one is short and inflected at its base. These parts are of a dark reddish brown colour, the legs, palpi, and nails of the mandibles being the reddest; the anterior part of the cephalothorax, the mandibles, maxillæ, and lip, which are the darkest, approaching to black. The abdomen is oval and hairy; its posterior extremity is broader than its anterior extremity, which projects a little over the base of the cephalothorax; its colour is yellowish brown, with numerous black spots above, and a black band, broad at the anterior part, but gradually becoming narrower as it approaches the spinners, extending along the medial line; on each side of this band is a series of short, oblique, yellowish brown lines, which, in some individuals, unite in the posterior region of the abdomen, forming angles whose vertices are directed forwards; a few minute, blackish spots occur on the under side of the abdomen. The plates of the spiracles are of a pale yellow colour. The superior spinning mammulæ, which are longer than the rest, rather prominent, and triarticulate, have the spinning tubes disposed on the under side of the terminal joint. The young resemble the female; but their colours are paler and their marks less distinct.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{11}{20}$ths of an inch; length of the cephalothorax $\frac{1}{4}$; breadth $\frac{3}{20}$; breadth of the abdomen $\frac{1}{5}$; length of a posterior leg $\frac{3}{5}$; length of a leg of the third pair $\frac{1}{2}$.

The male is similar to the female in colour, and in the relative length of its legs; but it is smaller, and appears to be much scarcer than that sex. The third and fourth joints of the palpi are short; the former has a large, pointed apophysis on the outer side, and the latter is provided with two apophyses; one on the outer side, which is acute, and the other in front, which is obtuse and short; the fifth joint is in the form of an elongated oval, pointed at the extremity; it is convex and very hairy above, concave beneath, comprising the palpal organs, which are complicated in structure, with a strong, curved spine on the inner side, and are of a red-brown colour.

I first observed this species in the spring of 1826, on Snowdon, in Caernarvonshire, under loose fragments of rock; and I have since met with it in various parts of North Wales, and in Lancashire, under stones, and in the crevices of walls. It spins a compact web, of small dimensions, from which a tube extends to its retreat, and it preys chiefly on *Coleoptera*. In the months of April and May it pairs, and the female deposits about a hundred and twenty spherical eggs of a yellowish white colour, which are not agglutinated together, in a lenticular cocoon composed of white silk, of a fine, compact texture, whose greatest diameter measures half an inch; it is usually attached to the under side of stones, and fragments of rock, by a small covering of web, on the exterior surface of which are frequently distributed small bits of earth and other extraneous materials.

In the *Philosophical Magazine*, vol. III, p. 436-7, Third Series, I have described this spider as a *Clubiona*, under the specific name *saxatilis;* on more mature consideration, however, I have been induced to remove it to the genus *Drassus;* as, notwithstanding it possesses several characters in common with the *Parcæ* of the genus *Clubiona*, it has, in its more essential organs, a direct affinity with the spiders constituting the section *Speophilæ* of M. Walckenaër.

Drassus parvulus.

The anterior part of the cephalothorax is very convex above, but depressed, and somewhat rounded, in front; the sides and posterior region are depressed; the former having several furrows, diverging from the superior part to the margins, and the latter an indentation in the medial line; the colour is very dark brown, five lines of white hairs, which unite at their extremities, occurring on the anterior convexity; the space below the eyes, and the base of the mandibles, are also supplied with white hairs. Four of the eight eyes are intermediate, and form a square; the other four, which are lateral, are disposed in pairs on the sides of the square; each pair being seated obliquely on a projection of the cephalothorax. The mandibles are strong, conical, perpendicular, and are armed with a few minute teeth on the inner surface. The maxillæ are powerful, convex underneath, enlarged at their extremities, and inclined towards the lip, which is large, oval, and rounded at the apex. The pectus is heart-shaped. These parts are of a very dark brown colour; the pectus being thinly covered with whitish hairs. The first pair of legs is the longest, then the second, the third pair being shorter than the fourth; these organs and the palpi are robust, and their colour is brown. Each tarsus is terminated by three claws; the two superior ones are deeply pectinated, and the inferior one is abruptly inflected near its base; the upper tarsal joint of the posterior legs is provided with a combing apparatus of fine spines, precisely similar in structure and situation to that of *Clubiona atrox*; it is also employed in the same manner, and for a like purpose. The abdomen is oval, convex above, projecting over the base of the cephalothorax; along the middle of the superior part a broad, dentated, dark brown band extends, which is generally bisected by an irregular, transverse, white line; between which and the spinners is a series of obscure, angular lines of a pale brown, or whitish hue, whose vertices are directed forwards; a deep border of dull white, which becomes narrower as it approaches the spinners, encompasses the dark brown band; and the sides are dark brown, mottled with white; the under side of the abdomen is dull white, a broad, dark brown band, marked with a few white spots, occupying the medial line. The plates of the spiracles are brown.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{11}$; length of an anterior leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{8}$.

The male, though smaller than the female, resembles it in colour, and in the relative length of its legs; but the mandibles, which are longer and slightly depressed before, have a small eminence in front, near their articulation, and are curved a little forwards at the extremity. The third and fourth joints of the palpi are short; the former is the stronger, and the latter has a pointed process projecting at right angles from the upper part, in front, and an obtuse apophysis at its anterior extremity, on the outer side; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, with a strong, spiny process curving from below upwards, and terminating in a spiral point, which extends nearly to the articulation of the third and fourth joints, and are of a reddish brown colour.

I discovered this small species in the autumn of 1832, among heath, in Trafford Park, near Manchester; and in the spring of 1833, I met with it, in great abundance, on gorse bushes, at Oakland, in Denbighshire. Its web, which is whitish, and irregular in structure, is fabricated at the extremities of the twigs of gorse. It pairs in May, and in the same month the female constructs two or three contiguous, lenticular, white cocoons, of a compact texture, measuring about $\frac{1}{6}$th of an inch in diameter, which she attaches to the stems of gorse surrounded by her web, enveloping them with the refuse of her prey. In each cocoon she deposits from ten to thirty spherical eggs of a pale yellow colour, which are not agglutinated together.

This spider, which on its first discovery I classed with the *Clubionæ*, and described under the specific appellation *parvula*, in the *Philosophical Magazine*, vol. III, p. 437-8, Third Series, I have since seen occasion to transfer to the genus *Drassus*, with the *Phytophilæ* of which genus it has a close affinity; though, as M. Walckenaër remarks, in treating upon this section in the *Faune Française, Aranéides*, p. 181, "on ne peut se dissimuler que ce petit groupe, dont les caractères ne sont pas assez tranchés pour former un genre, est d'une classification difficile et douteuse, et que, *Drasse* par ses organes les plus essentiels, il s'allie sous d'autres rapports aux *Clubiones* et aux *Théridions*."

A collection of *Araneidæ*, obligingly made for me by Mr. T. Parke, of Cheetham Hill, during a tour on the continent, in the autumn of 1833, contains specimens of the *Drassus viridissimus* of M. Walckenaër; from an examination of which I have ascertained the fact, that this species is provided with a combing apparatus on the upper tarsal joint of the posterior legs, resembling that of *Clubiona atrox*; and that it performs a similar function may be inferred from the structure of the web of this spider, which is described in the *Faune Française, Aranéides*, p. 178, as "dense et un peu frisée." Whether or not the *Drassus flavescens* of M. Kummer, the remaining species of the section *Phytophilæ*, is furnished with a comb, I have no means of deciding, as I have never seen it.

Drassus sylvestris.

The cephalothorax is oval, glossy, convex above, marked with slight furrows on the sides, and has a narrow, longitudinal indentation in the medial line of the posterior region; it is depressed in front, where the eyes are disposed in two transverse, parallel rows, somewhat curved, having their convexity directed backwards; the posterior row is rather the longer of the two, and the intermediate eyes, which are oval, and nearer to each other than they are to the lateral eyes of the same row, form a quadrangle with the intermediate eyes of the anterior row, which are the smallest of the eight. The mandibles are strong, conical, dentated on the inner surface, prominent at the base, and project a little forwards. The maxillæ are long, convex at the base, underneath, enlarged externally, where the palpi are inserted, and at the extremities, which are obliquely truncated on the inner side; they are depressed and contracted in the middle, and curved towards the lip, which is long, oval, convex at the base, and rounded at the apex. The pectus is of an oval form, pointed behind. The legs are robust, moderately hairy, and are furnished with a few small, sessile spines; the fourth pair is the longest, then the first, the third pair being the shortest. Each tarsus has a brush on the under side, and two curved claws, dentated at their base, at its extremity. The palpi, which are strong, are terminated by a single claw, dentated at the base. These parts are of a reddish brown colour, the mandibles, maxillæ, and lip being much the darkest. The abdomen is of an oblong oval figure, thickly covered with short hairs, and is of a dull olive-green colour, tinged with brown; a band of a somewhat deeper hue, broad before and tapering to a point behind, extends from the anterior part, contiguous to the cephalothorax, nearly two-thirds of its length, along the medial line; the interval comprised between it and the spinners being occupied by a series of obscure, hoary, angular lines, having their vertices directed forwards. The spinning mammulæ are prominent, cylindrical, and of a reddish brown colour. The sexual organs, which are semicircular, are of a dark reddish brown colour, approaching to black. The plates of the spiracles are large and yellow.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{2}{5}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{3}{20}$; breadth of the abdomen $\frac{1}{6}$; length of a posterior leg $\frac{9}{20}$; length of a leg of the third pair $\frac{7}{20}$.

I found specimens of this spider, which does not appear to belong to any of the sections into which M. Walckenaër has distributed the genus *Drassus*, in the woods at Oakland, in July, 1833; at which season of the year the female constructs a lenticular cocoon of white silk, of a fine, compact texture, about $\frac{3}{10}$ths of an inch in diameter, which she places in a semicircular cavity formed in the ground, beneath stones, and lined with silk; depositing in it between one and two hundred whitish eggs of a spherical form, not agglutinated together. She is greatly attached to her cocoon, and is with difficulty compelled to abandon it. Hitherto the male of this species has escaped my observation.

Drassus cupreus.

The cephalothorax is oval, convex above, and thinly covered with fine, short hairs or down; it is marked with slight furrows on the sides, and has a narrow, longitudinal indentation in the medial line of the posterior region. The eyes are disposed in front, in two transverse rows, somewhat curved, having their convexity directed backwards; the posterior row is rather the longer of the two, and the intermediate eyes, which are oval, and nearer to each other than they are to the lateral eyes of the same row, form a quadrangle with the intermediate eyes of the anterior row. The mandibles are strong, conical, armed with a few teeth on the inner surface, and project a little forwards. The maxillæ are long, convex at the base, underneath, enlarged externally, where the palpi are inserted, and at the extremities, which are obliquely truncated on the inner side; they are depressed and contracted in the middle, and are curved towards the lip, which is longer than broad, and truncated at the apex. The pectus is oval. The legs are robust, moderately hairy, and are provided with a few sessile spines; the fourth pair is the longest, then the first, the third pair being the shortest. Each tarsus has a climbing apparatus on the under side, and two pectinated claws at its extremity. A single, dentated claw terminates each palpus. These parts are of a pale reddish brown colour, a fine line of a blackish hue occurring on the margins of the cephalothorax, and a band of the same tint bordering the pectus and lip. The abdomen is of an oblong oval form, thickly covered with short hairs of a bright reddish copper colour, the under part being the palest; at the anterior extremity, contiguous to the cephalothorax, is a tuft of long, deep black hairs; a band of a blackish hue, broad before and tapering to a point behind, extending from it, along the medial line of the upper side, rather more than half the length of the abdomen. This band is not perceptible in some specimens. The plates of the spiracles are large, and of a pale yellow colour. The spinning mammulæ are prominent, and cylindrical; the inferior pair appearing to be the longest, when in a state of repose.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{2}{5}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{8}$; length of a posterior leg $\frac{1}{2}$; length of a leg of the third pair $\frac{2}{5}$.

The male resembles the female in colour, but as the fifth or terminal joint of the palpi, in all those individuals which have fallen under my observation, has been ovate in figure, and simple in structure, (the palpal organs not having been developed,) it is evident that they had not attained maturity.

This species, which has a close affinity with *Drassus sylvestris*, I have found enclosed in white, silken tubes, of a fine, compact texture, attached to the inferior surface of stones and fragments of rock, in the neighbourhood of Manchester, and near Llanrwst, in Denbighshire.

Genus.........*Textrix.*

Eyes eight in number, unequal in size, disposed in two transverse rows on the anterior part of the cephalothorax; four, constituting the anterior row, which is slightly curved, are adjacent and minute, the two intermediate ones being the smallest of the eight; the posterior row is greatly curved, with its convexity directed forwards; it comprises the other four eyes, which are large, and separated by wide intervals, the two intermediate ones being the largest of all.

Maxillæ powerful, curved towards the lip, enlarged and rounded at the apices.

Lip large and nearly quadrate.

Legs moderately long, tapering to their extremities; the fourth pair is the longest, the other three pairs being equal in length.

The spiders belonging to this genus are sedentary, constructing a horizontal web of a compact texture, with which a tube is connected conducting to the spider's retreat, in the crevices of rocks and walls, and in the intervals among stones.

Textrix agilis.

(Plate 3, fig. 1 and 2.)

The cephalothorax is inversely heart-shaped, but elongated, and very prominent before; the sides, which are glossy, slope abruptly, and are marked with deep furrows, extending from the carina to the margins, and a narrow, longitudinal indentation occupies the medial line of the posterior region; its colour is dark brownish black, with a yellowish white band of short hairs extending along the carina, and numerous long, black hairs in front. The mandibles are strong, conical, armed with a few teeth on the inner side, and inclined towards the pectus, which is heart-shaped. These parts, with the maxillæ and lip, are brownish black, the two latter organs being much the palest, particularly at their extremities. The legs and palpi are light brown, with brownish black bands, and are furnished with numerous erect, slender, black spines. There are three claws at the extremity of each tarsus; the two superior ones are long, curved, and deeply pectinated; and the inferior one is provided with a pair of small teeth on each side, near the base, where it is inflected; beneath the claws are two strong bristles, thickly clad with minute hairs on the under side. (In order to discern this structure a highly magnifying power must be employed.) A slender, curved, pectinated claw terminates each palpus. The abdomen is oval, projecting a little over the base of the cephalothorax; it is thickly covered with hair, and is black above, with a broad, dentated band along the middle, of a yellowish white colour; the anterior part of the band comprises four small, black spots, two on each side of the medial line, forming a parallelogram; the sides of the abdomen are mottled with yellowish white, and the under part is reddish brown, marked with a few minute, yellowish white and black spots. The plates of the spiracles are yellowish white. The superior spinning mammulæ, which are much longer than the rest, very prominent, and triarticulate, have the papillæ, or delicate tubes from which the silk issues in the act of spinning, disposed along the under side of the terminal joint; their colour, and that of the intermediate pair, is red-brown, the inferior pair being black.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, not including the spinners, $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{7}{20}$; length of a leg of the first, second, and third pairs $\frac{3}{10}$; length of a superior spinning mammula $\frac{1}{20}$.

The male is smaller and darker coloured than the female, but the relative length of its legs is the same; their absolute length, however, is greater, a posterior leg measuring $\frac{2}{5}$ths of an inch. The third and fourth joints of the palpi are short, the latter projecting a strong, acute apophysis from the outer side of its anterior extremity; the fifth joint is of an oblong oval figure, pointed before; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complex with prominent, curved, spiny processes, and are of a brownish black colour, tinged with red.

In the summer of 1830, I found this active spider on rocks and stone-walls in the pass of Llanberis, Caernarvonshire; and I have since met with it in abundance at Oakland, in Denbighshire, and in other parts of North Wales. The *Textrices* are nearly allied to the *Araneæ* of M. Latreille, which comprise the *Tegenariæ* and *Agelenæ* of M. Walckenaër, and the *Arachnæ* of M. Savigny. By the disposition of the eyes they also appear to connect the *Tubitelæ* with the *Citigradæ*, through the medium of the genus *Dolomedes*.

Genus......*Agelena*......Walckenaër.

Agelena brunnea.

The cephalothorax is oval, compressed before, convex above, and rather hairy, with depressed sides marked with furrows, diverging from the upper part towards the margins; it is of a red-brown colour, bordered by a fine, black line; on each side are black lines, forming several diverging, narrow triangles, whose vertices are directed towards the upper part of the cephalothorax; the small area enclosed by each being red-brown. The eyes are disposed on the anterior part of the cephalothorax in two transverse, curved rows, whose convexity is directed backwards; the eyes of the anterior row, which are near the frontal margin, are larger than those of the posterior row, the two intermediate ones being the largest of all. The mandibles are strong, conical, vertical, rather prominent at the base, and are armed with a few teeth on the inner surface. The maxillæ are short, convex underneath, rounded at the extremity, and inclined towards the lip, which is short, and nearly square, being rather narrower at the apex than at the base. The pectus is heart-shaped. The legs and palpi are moderately long and robust, and are provided with hairs and spines. These parts are of a red-brown colour, the lip being the darkest. The fourth pair of legs is the longest, then the first, the third pair being the shortest. Each tarsus is terminated by two pectinated claws, and the palpi have a single pectinated claw at their extremity. The abdomen, which is oval, is somewhat larger at its posterior than its anterior extremity, and projects over the base of the cephalothorax; its colour is yellow-brown, with indistinct, angular lines of a lighter shade, whose vertices are directed forwards, extending along the middle of the upper part, which, with the sides, is obscurely spotted with black, an irregular spot of a larger size occurring on each side of the spinners; on the under side are three very faint, longitudinal bands of a dull brown colour, which meet at the spinners. The plates of the spiracles are yellow. The spinning mammulæ are minute.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{13}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{2}{5}$; length of a leg of the third pair $\frac{1}{4}$.

This species, which appears to have a closer affinity with the *Agelenæ* than with the spiders of any other genus, occurs in the woods at Oakland; it is found occasionally under stones, but is by no means common. I am at present ignorant of its economy, and the male has not yet fallen under my observation.

Tribe......*Inequitelæ*.... Latreille.
Genus......*Theridion*......Walckenaër.
Theridion riparium.

The cephalothorax is inversely heart-shaped, convex and glossy above, with a large indentation in the medial line of the posterior region. The mandibles are small, conical, and perpendicular. The maxillæ incline towards the lip, which is quadrate; they are obliquely truncated on the outer side, at the extremity. The pectus is heart-shaped. The palpi are short and robust. These parts are of a red-brown colour, the cephalothorax and pectus being much the darkest. The legs are strong; the first pair is the longest, then the fourth, the third pair being the shortest; they are of a yellowish brown colour, with broad bands of red-brown. The eyes are situated on the anterior part of the cephalothorax; four, which are intermediate, form a square, the two in front being seated on a protuberance; the other four are disposed in pairs on the sides of the square; the eyes constituting each pair are placed obliquely on an eminence, and are contiguous. The abdomen, which is thinly covered with short hairs, is remarkably convex, projecting over the base of the cephalothorax; it is red-brown above, mottled with black and white, and is bisected by an irregular, transverse, white line, interrupted in the middle by a triangular, black spot, between which and the spinners is a curved, transverse, black line; the under side of the abdomen is brownish black, with a transverse band of a red-brown colour near the spinners. The plates of the spiracles are red-brown.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{7}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{3}{10}$; length of a leg of the third pair $\frac{3}{20}$.

The female of this species spins an irregular web of fine, glossy lines under the projections of broken, precipitous banks, in the woods about Oakland. In the month of August she constructs a long, slender, conical, upright tube of silk, of a slight texture, measuring from one and a half to two and a half inches in length, and about half an inch in diameter at the lower extremity: it is closed above, open below, and thickly covered on the outside with bits of earth, minute pebbles, dried leaves, flowers of heath, &c. Suspended from the projection of the bank, to which the web is attached, by strong lines connected with the apex, and united to the web laterally by numerous slender threads, the tube is held firmly in its position. In the upper part of this curious domicile, the spider fabricates two or three slight, globular cocoons of yellowish white silk, about $\frac{1}{10}$th of an inch in diameter, in each of which she deposits from ten to thirty spherical eggs of a yellowish white colour. The young continue with the mother till they have attained a considerable size, and are provided by her with prey, as the contents of the tube plainly indicate. I have not succeeded in capturing an adult male of this species of *Theridion*.

Theridion pallens.

This species has the cephalothorax inversely heart-shaped, convex above, glossy, depressed in the posterior region, with an indentation in the medial line. The mandibles are small, conical, and perpendicular. The maxillæ are obliquely truncated at the extremity, on the outer side, and incline towards the lip, which is triangular. The pectus is heart-shaped. The legs and palpi are moderately strong, and are furnished with hairs and fine spines. These parts are of a pale yellow, or yellowish white colour, the legs and palpi being the palest; the pectus has a tinge of green, and a broad, obscure band of dark dull green extends along the medial line of the cephalothorax. The first pair of legs is the longest, then the fourth, the third pair being the shortest. The eyes are situated on the anterior part of the cephalothorax; four, which are intermediate, form a square, the two in front being seated on a protuberance; the other four are disposed in pairs on the sides of the square; the eyes constituting each pair are placed obliquely on an eminence, and are contiguous. The abdomen is globose, projecting greatly over the base of the cephalothorax, and is thinly covered with short hairs; it is of a pale yellow colour, mottled with spots of a lighter hue; above the spinners is a dark, indistinct spot; and on the under side are two obscure bands of a dull greenish colour; they are oblique, converging towards the sexual organs, the margins of which are black. The plates of the spiracles are of a pale yellow colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{12}$th of an inch; length of the cephalothorax $\frac{1}{28}$; breadth $\frac{1}{30}$; breadth of the abdomen $\frac{1}{15}$; length of an anterior leg $\frac{1}{10}$; length of a leg of the third pair $\frac{1}{18}$.

The female spider described above is the only individual of the species which I have seen. It was taken in June, 1834, on iron rails at Crumpsall Hall.

Genus.........*Manduculus.*

Eyes eight in number, unequal in size, arranged in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones, which are the largest, form a square, and the other four are disposed obliquely, in pairs, on the sides of the square, the eyes constituting each pair being placed on a small eminence, and nearly contiguous.

Maxillæ long, inclined towards the lip, enlarged at the base, where the palpi are inserted, and slightly so at the apices, which converge abruptly and are contiguous.

Lip large, triangular, truncated at the vertex.

Legs long and slender; the first pair is the longest, then the second, the third pair being considerably the shortest.

Mandibles very powerful, convex in front, diverging widely at their lower extremities, and armed with a long, moderately curved nail, and two rows of teeth on the inner side. Those of the male have an obtuse, conical prominence near the insertion of the nail, which latter appendage has a small indentation about the middle, externally, and a corresponding projection, or minute tooth, within.

Manducculus ambiguus.

(PLATE 3, fig. 3, 4, 5.)

The cephalothorax is rather large, convex above, and glossy; it is of an oval form, truncated in front, with an indentation in the medial line of the posterior region; the colour is light reddish brown, with a black band along the middle, one on each side, just above the margins, and a short, black streak directed backwards from each lateral pair of eyes. The pectus is heart-shaped, and its colour is rather darker than that of the cephalothorax. The colour of the mandibles is light reddish brown, that of the maxillæ and lip being dark red-brown. The legs and palpi are yellowish brown; they are sparingly supplied with hair, but the former are destitute of spines. Each tarsus has three claws at its extremity; the two superior ones are finely pectinated, and the lower one is abruptly inflected near its base. A single claw, pectinated about one third of its length from the base, (the last tooth of the series being much the longest,) terminates each palpus. The abdomen is oval, slightly prominent before, projecting a little over the base of the cephalothorax; the colour is yellowish brown above, irregularly bordered with black; a narrow, longitudinal band of pale yellow, having its anterior half bordered with black, and comprising a slender, black streak, occupies the medial line. Along each side extends a broad band of dull yellow, which is palest on the upper edge and tinged with light brown below. Underneath, the abdomen is yellowish brown, with a band of a darker hue along the middle, bounded on each side by a faint yellow line, and the plates of the spiracles are yellow. The spinning mammulæ are small, conical, and converging. This species varies considerably in colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{9}$; breadth $\frac{1}{11}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{3}{8}$; length of a leg of the third pair $\frac{1}{5}$.

The male, which is a little smaller than the female, has the abdomen more distinctly marked; the upper part being almost black, and the medial and lateral bands nearly white, in some specimens. The third joint of the palpi is strong and very short; the fourth is dilated regularly to its anterior extremity; and the fifth or terminal joint has two slender apophyses; the shorter one attached to the upper side of the palpal organs; the longer connected with the same organs on the inner side and extending beyond them. The palpal organs are glossy, of a globular form, with a pointed elongation anteriorly, and their colour is very dark reddish brown, approaching to black.

This spider, which was discovered by Mr. T. Blackwall, in September, 1831, under stones and rubbish in the township of Crumpsall, pairs in the month of October. In it are combined several striking characteristics of the genera *Theridion* and *Tetragnatha*. Allied to the former by the structure of the mouth, and the irregularity of the insignificant web it fabricates; it resembles the latter in the form and relative length of the legs, which it frequently extends in the same manner as *Tetragnatha extensa*; thus closely connecting by its organization and economy the *Inequitelæ* with the *Orbitelæ*.

Genus......*Neriene*.

Eyes eight in number, unequal in size, disposed in two transverse rows on the anterior part of the cephalothorax; the intermediate eyes of both rows form a trapezoid, whose anterior side is considerably the shortest; the lateral ones are placed obliquely in pairs, each pair being seated on a small eminence, and geminated; the posterior eyes of the trapezoid are larger, and the anterior ones much smaller than the rest.

Maxillæ strong, inclined towards the lip, slightly dilated at the base, where the palpi are inserted, and at the apex, which is obliquely truncated externally.

Lip short, broad, prominent at the apex, and semicircular.

Legs moderately long and robust; the anterior and posterior pairs, which are the longest, equal in length, or nearly so; the third pair is the shortest.

The spiders of this genus fabricate small, horizontal sheets of web, of a slight texture, among coarse herbage, or in cavities beneath stones, on the under side of which they take their station, in an inverted position, and watch for their prey.

Neriene marginata.

(PLATE 3, fig. 6 and 7.)

The cephalothorax is oval and glossy; the anterior part, on which the eyes are seated, is elevated, but obtuse, the posterior part being depressed, with an indentation in the medial line. The mandibles are strong, armed with teeth on the inner surface, and inclined towards the pectus, which is heart-shaped. The maxillæ are enlarged at their apices, and slightly inclined towards the lip. These parts are of a very dark brownish black colour. The legs and palpi are provided with erect spines, and their colour is reddish brown, with bands of a darker hue. Both of the superior tarsal claws have a series of minute teeth, extending rather more than a third of their length from the base, the terminal one being the longest; and the inferior claw is abruptly inflected near its articulation with the tarsus. A plain claw, slightly curved, terminates each palpus. The abdomen is oval, rather convex above, projecting over the base of the cephalothorax; the upper part is brownish black, bordered by a dentated band of pale brown, thickly spotted with white, which passes above the spinners, but whose continuity is interrupted in front by a black streak intersecting it at right angles; a series of curved, angular lines of a pale brown colour, minutely spotted with white, extends along the middle; their convexity is towards each other, and their apices are directed forwards. The sides and under part of the abdomen are brownish black, marked with a few white spots, four minute ones, describing a large quadrangle, occurring on the latter. The plates of the spiracles are of a very dark red-brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{13}$; length of a fore leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{6}$.

The male resembles the female in colour, and in the relative length of its legs, but the absolute length of those organs is greater, an anterior one measuring $\frac{1}{4}$th of an inch. The third and fourth joints of the palpi are short, the latter, which is much the stronger, being fringed with long bristles on the outer side of the upper part; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complex with spiny processes, and of a brownish black colour, tinged with red. Very old males are darker coloured, and have red legs.

In the months of October and November this spider is common in the plantations about Crumpsall Hall, where it may be seen occupying the under side of its web, which is constructed among the long grass beneath the trees, on a plan similar to that employed by the spiders of the genus *Linyphia*.

Neriene bicolor.

The cephalothorax is inversely heart-shaped, convex above, and glossy, with an indentation in the medial line of the posterior region. The mandibles are robust, conical, perpendicular, and furnished with teeth on the inner surface. The maxillæ are enlarged at the apices, and slightly inclined towards the lip. The pectus is heart-shaped. In structure and relative length the legs and palpi are similar to those of *Neriene marginata*, but each of the superior tarsal claws is provided with a series of minute teeth of greater extent, occupying about half of its length. The colour of these parts is red-brown, the pectus, lip, maxillæ, and margins of the cephalothorax, being the darkest, and the eyes are placed on black spots. The abdomen is oval, convex above, projecting over the base of the cephalothorax; it is thinly clad with hair, glossy, and of a brownish black colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{5}$.

The male, though rather smaller than the female, resembles it in colour, and in the relative length of its legs, but the anterior part of the cephalothorax is supplied with slender bristles curved forwards. The third and fourth joints of the palpi are short; the former is terminated by a fine bristle in front, and the latter, which is the stronger, has a small protuberance on the outer side of the upper part, fringed with long bristles; the fifth joint has a large, obtuse apophysis near its articulation with the fourth; it is of an oval form, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and of a dark red-brown colour.

This species abounds in the plantations about Crumpsall Hall, constructing, in the long grass under the trees, a web similar to that of *Neriene marginata.* It is of frequent occurrence also under stones.

Neriene rufipes.

This species has the cephalothorax of an oval form; it is convex above, and glossy, with the anterior part, about the region of the eyes, rounded and somewhat depressed, and in the medial line of the posterior part a small indentation occurs. The mandibles are powerful, conical, provided with teeth on the inner surface, and inclined a little towards the pectus, which is heart-shaped. The maxillæ, which are enlarged at the apices, incline towards the lip. The legs and palpi are similar in structure and relative length to those of *Neriene bicolor.* These parts are of a light red-brown colour, the mandibles, pectus, lip, and maxillæ, being the darkest, and the eyes are placed on black spots. The abdomen is oval, slightly convex above, projecting over the base of the cephalothorax; it is rather hairy, glossy, and brownish black. The plates of the spiracles are large, and of a yellowish white colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{12}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{16}$; length of a fore leg $\frac{1}{5}$; length of a leg of the third pair $\frac{1}{6}$.

Though somewhat smaller, the male resembles the female in colour, and in the relative length of its legs. The second joint of the palpi is enlarged at its anterior extremity; the third and fourth joints are short; the former, which is the larger, is provided with a few long bristles in front of its anterior extremity, and the latter has an obtuse apophysis on the under side of the upper part; the fifth joint is oval, with a small protuberance or apophysis on the inner side, near its articulation with the fourth joint; it is convex and hairy externally, concave within, and comprises the palpal organs, which are complicated with spiny processes, highly developed, and of a dark red-brown colour.

Specimens of this spider were obtained in the autumn of 1832, under stones, and on rails, in the township of Crumpsall. The female fabricates two or three globular cocoons of yellowish white silk, of a slight texture, measuring about $\frac{1}{6}$th of an inch in diameter; these cocoons she attaches to the inferior surface of stones, and, in the month of June, deposits in each of them forty or fifty spherical eggs of a yellowish white colour, not agglutinated together.

Neriene rubens.

The cephalothorax is inversely heart-shaped, slightly convex above, and glossy, with a depression and an indentation in the posterior region; in front is an abrupt eminence, on which are the eyes, placed on black spots. The mandibles are robust, conical, strongly toothed on the inner surface, and inclined towards the pectus, which is heart-shaped. The maxillæ incline towards the lip, and are moderately enlarged at their apices. The legs and palpi are hairy; the former are provided with a few spines, and each tarsus is terminated by three claws, the inferior one being abruptly inflected near its base, and the two upper ones pectinated. The palpi are abundantly supplied with black spines, one, longer than the rest, projecting from the anterior extremity of the third joint. These parts, with the exceptions already noticed, are of a yellowish red colour. The abdomen is oval, somewhat convex above, projecting over the base of the cephalothorax; it is thinly clad with hair, glossy, and of a red-brown hue, which varies in intensity in different individuals. The sexual organs are black, with a tinge of red, and the plates of the spiracles are pale orange.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{18}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{8}$.

The male is rather smaller than the female, but the relative length of its legs is the same; the tibiæ of the first and second pairs are dilated underneath, at their anterior extremities, and these enlargements are thickly clad with long, fine hairs. The second joint of the palpi is very powerful, enlarging gradually from the base to its anterior extremity, which is armed with a strong spur, and a great number of minute, sharp-pointed, black spines, on the upper side; the third joint is short and robust;

the fourth is furnished with two apophyses; the inner one is much the longer, and tapers to a point; it is curved obliquely across the upper side of the fifth joint, and is provided with a strong, projecting point near its base; the exterior apophysis is much shorter and more obtuse; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are complicated in structure, exhibiting several curved, spiny processes, and are of a dark red-brown colour.

Mr. T. Blackwall found this species among heath, in Trafford Park, near Manchester, in October, 1832, at which season of the year it pairs.

Neriene cornuta.

The cephalothorax is glossy, inversely heart-shaped, depressed behind, with a large indentation in the medial line, and the sides are marked with furrows extending from the superior part to the margins; the anterior part is elevated, and surmounted by two large, conical protuberances, directed forwards, below which, in front, the eyes are situated. The mandibles are strong, conical, perpendicular, and armed with teeth on the inner surface. The maxillæ are inclined towards the lip, which they encompass. The lip is short, prominent at the apex, and semicircular. The pectus is convex and heart-shaped. These parts are of a very dark brown colour, the anterior portion of the cephalothorax being almost black. The colour of the legs and palpi is light red-brown. Each tarsus is terminated by three claws; the two superior ones are slightly pectinated, and the inferior one is inflected near its base. The fourth joint of the palpi is shorter than the third, and projects three apophyses from its anterior extremity; one, on the inner side, which is long, slender, curved, and pointed; a small one, in front, which is also curved, and pointed; and one, on the under side, which is short, and obtuse; the fifth joint is oval, convex and hairy above, concave within, comprising the palpal organs; they are highly developed, complex with spiny processes, and are of a dark red-brown colour. The abdomen is oval, rather convex above, projecting over the base of the cephalothorax; it is sparingly supplied with short hairs, and is glossy black, with the exception of the plates of the spiracles, which are of a pale yellow colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{22}$; breadth of the abdomen $\frac{1}{21}$; length of an anterior leg $\frac{3}{20}$; length of a leg of the third pair $\frac{1}{9}$.

I captured males of this species in May, 1833, on rails and gates at Oakland; and in June, 1834, I found specimens, in similar situations, at Crumpsall Hall; but the female has hitherto escaped detection.

Neriene vagans.

The cephalothorax is oval, convex above, and glossy; it is somewhat depressed in front, where the eyes are situated, also on the sides, and in the posterior region, where a slight indentation occurs. The mandibles are strong, conical, armed with teeth on the inner surface, and incline a little towards the pectus, which is heart-shaped, and convex underneath. The maxillæ are enlarged at the base, where the palpi are inserted, and slightly so at the extremity; they incline towards the lip, which is semicircular, and prominent at the apex. The colour of these parts is deep brown, the lip being the darkest. The intermediate eyes of the anterior row are very minute and near to each other. The legs and palpi are of a red-brown colour. Each tarsus has three claws at its extremity; the two superior ones are pectinated, and the inferior one is inflected near its base. The abdomen is oval, convex above, projecting over the base of the cephalothorax; it is thinly clad with hair, glossy, and black. The plates of the spiracles are of a yellowish brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{12}$th of an inch; length of the cephalothorax $\frac{1}{24}$; breadth $\frac{1}{28}$; breadth of the abdomen $\frac{1}{24}$; length of an anterior leg $\frac{1}{9}$; length of a leg of the third pair $\frac{1}{12}$.

The male resembles the female in colour, and in the relative length of its legs. The second joint of the palpi is long; the third is rather long, clavate, slightly curved downwards, and fringed with bristles, longitudinally, on the upper side; the fourth, which is short and strong, has an obtuse apophysis underneath, and a long one in front, on the inner side, curving upwards and outwards at its extremity, which is somewhat enlarged, and rounded; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are moderately developed, with several curved, spiny processes at the extremity, and are of a blackish brown colour.

I captured specimens of this species on iron rails at Crumpsall Hall, in the spring of 1834.

Neriene pygmæa.

The cephalothorax of this minute spider is oval, glossy, convex above, with the sides somewhat depressed, and a small indentation in the medial line of the posterior region. The mandibles are strong, conical, armed with teeth on the inner surface, and slightly inclined towards the pectus, which is heart-shaped. The maxillæ are enlarged at the extremity, and they incline towards the lip, which is semicircular, and prominent at the apex. The cephalothorax, pectus, and lip are brown-black; the mandibles and maxillæ being of a dark reddish brown colour. The legs and palpi are provided with hairs and fine spines, and their colour is bright rufous. Each tarsus has three claws at its extremity; the two superior ones are minutely dentated, and the inferior one is inflected near its base. The abdomen is oval, projecting a little over the base of the cephalothorax; it is sparingly clad with hair, glossy, and brownish black. The plates of the spiracles are brown.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{11}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{28}$; breadth of the abdomen $\frac{1}{25}$; length of an anterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{10}$.

The male resembles the female in colour, and the relative length of its legs is the same as in that sex. The third and fourth joints of the palpi are short, the latter being much the stronger, and prominent in front; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and of a dark reddish brown colour.

I found this species in considerable abundance in the month of March, 1833, on iron rails at Crumpsall Hall; and in the autumn of the same year I procured specimens in the vicinity of Llanrwst, in Denbighshire.

Neriene nigra.

The cephalothorax is inversely heart-shaped, inclining to oval, convex above, glossy, marked on the sides with slight furrows diverging from the superior part towards the lateral margins, prominent in front, and depressed in the posterior region, with an indentation in the medial line. The intermediate eyes of the anterior row are very minute and near to each other. The mandibles are strong, conical, armed with teeth on the inner surface, and slightly inclined towards the pectus, which is heart-shaped. The maxillæ are enlarged at the extremity, and they incline towards the lip, which is semicircular, and prominent at the apex. These parts are of a brownish black colour, the mandibles and maxillæ having a faint tinge of red. The legs and palpi are provided with hairs and a few delicate spines, and are of a red-brown colour. Each tarsus has three claws at its extremity; the two superior ones are minutely dentated, and the inferior one is inflected near its base. The abdomen is oval, convex above, projecting over the base of the cephalothorax; it is thinly clad with hair, glossy, and brownish black. The plates of the spiracles are of a brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{23}$; breadth of the abdomen $\frac{1}{20}$; length of a fore leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{10}$.

The male resembles the female in colour, with the exception of its legs, which are redder. The relative length of the organs of progression is the same in both sexes. The third joint of the palpi is long and clavate; the fourth is strong, and is elongated before into a narrow, oval process tapering to a point, which extends in front of the fifth joint; this latter joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complex with spiny processes, one of which, on the outer side, near the extremity, is curved into a circular form, and are of a dark red-brown colour.

Specimens of this spider were captured in the autumn of 1833, on posts and rails at Oakland, and at Crumpsall Hall.

Neriene lugubris.

The cephalothorax of the male is oval, convex above, and glossy; it is rather prominent before, where the eyes are situated, and is depressed on the sides, and in the posterior region, where there is an indentation in the medial line. The mandibles are strong, conical, armed with small teeth on the inner surface, and inclined towards the pectus, which is convex and heart-shaped. The maxillæ are robust, and incline towards the lip, which is semicircular, and prominent at the apex. These parts are of a blackish brown colour. The legs are red-brown. Each tarsus has three claws at its extremity; the two superior ones are minutely pectinated, and the inferior one is inflected near its base. The palpi are of a blackish brown colour; the third and fourth joints are short; the latter, which is much the stronger, has an obtuse apophysis underneath, and a larger one in front, curved outwards and somewhat pointed at the extremity; the fifth joint is oval, with a bold protuberance on the outer side, near its articulation with the fourth joint; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a strong spiny process curving downwards from the outer side of the upper part, and are of a reddish brown colour. The convex sides of the terminal joints of the palpi are directed towards each other. The abdomen is oval, convex above, projecting over the base of the cephalothorax; it is thinly covered with hair, and is black, with the exception of the plates of the spiracles, which are of a dark brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{12}$th of an inch; length of the cephalothorax $\frac{1}{24}$; breadth $\frac{1}{30}$; breadth of the abdomen $\frac{1}{25}$; length of an anterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{11}$.

Specimens of this species, all of them males, were taken on iron rails at Crumpsall Hall, in June, 1834.

Neriene fusca.

The cephalothorax is oval, convex above, and glossy; it is depressed on the sides, and in the posterior region, where there is an indentation in the medial line; its colour is yellowish brown, the lateral margins being the darkest; on the frontal margin, immediately above the base of each mandible, is a triangular spot of a red-brown colour. The eyes are placed on black spots. The mandibles are strong, conical, convex in front, armed with small teeth on the inner surface, of a pale red-brown colour, and are inclined towards the pectus, which is heart-shaped, and brown, the margins being rather the darkest. The maxillæ are powerful, and encompass the lip, which is semicircular, and prominent at the apex. The former are of the same colour as the mandibles, and the latter is dark brown, with a reddish tinge at the tip. The legs are robust; the fourth pair is rather longer than the first, which a little exceeds the second in length, the third pair being the shortest. These organs, and the palpi, are of a yellowish brown colour. Each tarsus has three claws at its extremity;

the two superior ones are minutely pectinated, and the inferior one is inflected near its base. The abdomen is oval, convex above, projecting over the base of the cephalothorax; it is sparingly covered with hair, and is of a dark brown colour, the medial line of the upper and under sides being slightly paler. The plates of the spiracles are yellow.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{9}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{26}$; breadth of the abdomen $\frac{1}{20}$; length of a posterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{9}$.

The male is smaller than the female, but the relative length of its legs is the same. The cephalothorax, in old individuals, is more gibbous immediately behind the eyes, and its colour, with that of the mandibles, maxillæ, pectus, legs, and palpi, is red-brown. The abdomen is blackish brown. The fourth joint of the palpi is stronger than the third; it projects a small, acute apophysis underneath, and a larger one in front, which terminates in two points; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, with a short, curved, obtuse spine at the upper part, on the under side, and a small, pointed one, curved into a semicircular form, at the extremity; they are of a red-brown colour.

This species is of frequent occurrence on rails and gates in the townships of Crumpsall and Cheetham. It pairs in the month of June.

Closely allied to the spiders of the genus *Linyphia* by the disposition and relative size of their eyes; but approximating more nearly to those of the genus *Theridion* in the structure of the organs of manducation, and in the relative length of their legs, the *Nerienæ* present another striking instance of propinquity between the *Inequitelæ* and *Orbitelæ;* a connexion which is further established by the mixed character of their economy. They bear a strong resemblance also, in their general structure, to the spiders constituting the genus *Walckenaëria.*

Tribe......*Orbitelæ,* } Latreille.
Genus ....*Linyphia,* }

Linyphia minuta.

The cephalothorax is glossy, inversely heart-shaped, prominent before, with an indentation in the medial line of the posterior region, and is of a dark brown colour; the pectus is heart-shaped, and its hue is very dark brown, approaching to black. The mandibles, which are strong and vertical, are of a dark red-brown colour. The maxillæ are straight and nearly quadrate, having the exterior angle, at the apex, curvilinear; the lip is short and semicircular. The colour of these organs is the same as that of the mandibles. The legs and palpi are slender, of considerable length, and are supplied with numerous delicate spines; they are reddish brown, with brownish black bands. The first pair of legs is the longest, then the second, which is a very little longer than the fourth, the third pair being the shortest. Each tarsus is provided with three claws at its extremity; an angular inflection occurs near the insertion of the inferior one, and each of the upper claws has a series of minute, closely set teeth, extending from the base about two thirds of its length, the terminal one being decidedly longer than the rest. At the extremity of each palpus is a slightly curved claw, which has half of its extent occupied by a row of exceedingly small teeth. Four of the eight eyes are intermediate, forming a trapezoid, whose shortest side is in front; the other four are disposed in pairs, nearer the sides of the cephalothorax, the eyes constituting each pair being contiguous, and placed obliquely on an eminence; the two posterior eyes of the trapezoid are the largest, and the two anterior ones the smallest of the eight. The abdomen is oval, convex above, projecting over the base of the cephalothorax, and is thinly clad with hair; the upper part is pale brown, minutely spotted with yellowish white; along the middle extends a series of strongly marked, brownish black, angular lines, with their points directed forwards, and a little above the spinners is an irregular, transverse, semicircular line of a yellowish white colour. The sides are brownish black, with a slightly curved line of yellowish white extending from the anterior part rather more than half way towards the spinners; beneath, the abdomen is of a brownish black colour, and the plates of the spiracles are yellowish white.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen,

$\frac{1}{6}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{13}$; length of an anterior leg $\frac{3}{10}$; length of a leg of the third pair $\frac{1}{4}$.

The body of the male is smaller and more slender than that of the female, but the legs are longer, an anterior one measuring $\frac{7}{20}$ths of an inch. The third and fourth joints of the palpi are short and strong, one or two long bristles projecting from the upper part of the anterior extremity of the former, which is very prominent; the fifth has two conical processes, or apophyses, on the upper part, near its articulation with the fourth joint; it is convex and hairy externally, concave within, and comprises the palpal organs, which are highly developed, complex with spiny processes, and are of a red-brown colour.

I first observed this spider in uninhabited and little frequented rooms in Crumpsall Hall, and have since met with it in other localities. In the corners of windows, and the angles of walls, it fabricates a delicate, horizontal sheet of web, which, in addition to its lateral points of contact, is supported and strengthened by fine lines united at various angles, and connected with objects above and below it. Like its congeners, this species takes its station on the under side of the horizontal sheet, in an inverted position, and there watches for its prey, on which it rushes with great rapidity. It does not confine itself solely to the interior of buildings, but may frequently be found on trees and shrubs, particularly such as grow against walls. In the month of September it deposits thirty or forty spherical eggs of a yellowish white colour, in a cocoon of white silk, of a slight texture and subglobose form, measuring about $\frac{1}{5}$th of an inch in diameter. It frequently happens that two cocoons, apparently belonging to the same female, are attached to objects contiguous to the same web. The young, after the first moult, resemble the mother, but their colours are rather paler.

Having, in numerous instances, traced the new spider through its various stages of growth, I find that, when arrived at maturity, it differs from the two other species of the genus *Linyphia* described by naturalists, in size, colour, and structure; but as organic distinctions present specific characters the most decisive, it will suffice to remark, that the female has a flesh-coloured, cylindrical protuberance, enlarged at the extremity, and directed backwards, in connexion with the sexual organs. This process is altogether wanting in *Linyphia triangularis*, and, if it exist at all, in *Linyphia montana* is not conspicuous externally. The male of the latter species has the palpal organs very much more complicated and highly developed than the male of *Linyphia minuta ;* the same organs being less complex, proportionally less developed, and of a more oval form, in *Linyphia triangularis*, which is readily distinguished also by the large size of its mandibles.

The article "*Linyphie*," in the second edition of the *Nouveau Dictionnaire d' Histoire Naturelle*, which is from the pen of M. Latreille, contains the following passage. "Ces petits," the young of *Linyphia triangularis*, "différant des adultes par la couleur noire et luisante de leur corps, hormis les pattes qui sont safranées, restent dans cet état jusqu'aux premiers jours du printemps, où ils commencent à former de petites toiles. On distingue déjà les mâles à la forme du dernier article des palpes." Now the young of *Linyphia triangularis* have the sides and superior region of the abdomen uniformly marked with white lines; it is probable therefore, that *Erigone atra*, or adults of some other minute species, may be here referred to.

Linyphia luteola.

This spider resembles *Linyphia minuta* in the form of the cephalothorax, except that the anterior part, on which the eyes are seated, is more prominent and acute; it is glabrous, and of a pale yellowish brown colour, with black margins, and a slender band of the same hue along the medial line. The eyes are placed on black spots, their arrangement and relative size being the same as in *Linyphia minuta*. The parallelism between the two species holds good also as regards the structure of the mandibles, the maxillæ, the lip, and the pectus. The colour of these parts is the same as the ground of the cephalothorax. The legs are long and slender; the palpi rather short; both are provided with claws and delicate spines, similar in structure to those of *Linyphia* *minuta*; their colour is a uniform pale yellowish brown. The first pair of legs is the longest, then the second, the third pair being the shortest. The abdomen is oval, compressed, remarkably convex above, projecting over the base of the cephalothorax; its colour is pale yellow, with minute white spots on the upper part; the sides are obscurely marked with oblique lines of a blackish hue, and above the spinning mammulæ are several of a similar tint, and an angular form. The plates of the spiracles are yellow. In some individuals scarcely a trace of the black lines can be perceived.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{2}{5}$; length of a leg of the third pair $\frac{1}{4}$.

The male is smaller and more slender than the female, but the cephalothorax is longer, measuring $\frac{1}{10}$ of an inch; it is very prominent and acute before, and is furnished with numerous, strong, black bristles, particularly at the apex. The legs also are more elongated, an anterior one measuring $\frac{9}{20}$ths of an inch. The maxillæ are exceedingly convex externally, immediately above the insertion of the palpi; the second joint of the latter organs is robust; the third and fourth joints are very short, a strong bristle, rough with projecting points on the under side, depending from a prominence on the upper part of the anterior extremity of the former; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are complex, with a curved, pointed projection on the upper part; their colour is red-brown.

This species of *Linyphia* is plentiful in September and October, in the plantations about Crumpsall Hall, constructing, among the coarse grass beneath the trees, a horizontal sheet of web, about three inches in diameter, on a plan similar to that employed by the other species of the genus. Like them, too, it is usually found on the under side of the horizontal sheet, in an inverted position.

Linyphia pusilla.

As this spider bears a striking resemblance to *Linyphia minuta*, it will suffice to point out those particulars in which it differs from that species. It is smaller, of a more slender form, and the colour of the legs and palpi is plain yellowish brown. The upper part of the abdomen is pale brown, and along the middle extends a series of strongly marked, brownish black, angular lines, having their vertices directed forwards; the sides and under part are dark brownish black; and the plates of the spiracles are of a brown colour. The female has no cylindrical appendage in connexion with the sexual organs.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{11}$th of an inch; length of the cephalothorax $\frac{1}{25}$; breadth $\frac{1}{28}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{8}$.

The abdomen of the male is more slender, and darker coloured, than that of the female, but the relative length of its legs is the same; their absolute length, however, is greater, an anterior one measuring $\frac{1}{4}$th of an inch. The third and fourth joints of the palpi are short, the latter being very strong, and prominent in front; the fifth joint is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complicated in structure, and of a red-brown colour.

This species is common in autumn on rails in the vicinity of Manchester, and in the neighbourhood of Llanrwst.

Linyphia marginata.

In colour and design this spider bears a close resemblance to *Neriene marginata*, but in external structure it is decidedly a *Linyphia.* The cephalothorax is oval, prominent before, and glossy; the sides and posterior part are depressed, the former having several slight furrows, extending from the carina to the margins, and the latter a large indentation in the medial line. The mandibles are strong, conical, armed with two rows of teeth on the inner surface, and inclined towards the pectus, which is heart-shaped. The maxillæ are robust and somewhat quadrate, having the exterior angle, at the extremity, curvilinear. The lip is short, prominent at the apex, and semicircular. These parts are of a very dark brown colour, the pectus, which is the darkest, being almost black. The eyes are eight in number, unequal in size, disposed in two transverse rows on the anterior part of the cephalothorax; the intermediate eyes of both rows form a trapezoid, whose anterior side is considerably the shortest, and the lateral ones are placed obliquely in pairs, each pair being seated on a small eminence, and geminated; the posterior eyes of the trapezoid are much the largest, and the anterior ones are the smallest of the eight. The legs are long and slender, and are furnished with numerous, fine, erect spines; their colour is yellowish brown, with brownish black bands. Each tarsus has three claws at its extremity; the two superior ones are closely dentated nearly half their length, the terminal tooth being the longest, and the inferior one is inflected near its base, where there are one or two very minute teeth. The palpi are filiform, and resemble the legs in colour; they are provided with slender spines, and are terminated by a slightly curved claw, having a series of very small teeth, extending about a third of its length from the base, the terminal one being the longest. The abdomen is oval, convex above, projecting over the base of the cephalothorax, and is sparingly covered with short hairs; the upper part is brownish black, bordered by a broad, irregular, dentated, brown band, which passes above the spinners, but whose continuity is interrupted in front by a black streak intersecting it at right angles; this band is very thickly spotted with white anteriorly, the white spots on the posterior portion being fewer, smaller, and intermixed with some of a blackish hue; an indistinct series of curved, angular lines, of a brown colour, extends along the middle; their convexity is towards each other, and their apices are directed forwards; above the spinners are several small, yellowish white spots; the sides are brown, minutely spotted with white, and a curved, brownish black band extends from the anterior part of each nearly half way towards the spinners; the under side of the abdomen is dark brown, with four minute, yellowish white, compound spots, forming a large quadrangle. The sexual organs are prominent, cylindrical, and brownish black; and the plates of the spiracles are of a brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen,

$\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{13}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{9}{20}$; length of a leg of the third pair $\frac{3}{10}$.

The abdomen of the male is more slender than that of the female, and darker coloured, but the relative length of the legs is the same; the absolute length of these organs, however, is greater, an anterior leg measuring $\frac{11}{20}$ths of an inch. The third and fourth joints of the palpi are short, the latter, which is much the stronger, being fringed with long bristles on the outer side of the upper part; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complex with spiny processes, and are of a dark reddish brown colour.

I discovered this species in the autumn of 1832, in the plantations about Crumpsall Hall; and in the ensuing year I met with it in the woods at Oakland, in the month of May, at which season it pairs. In its habits, and in the construction of its web, which is usually fabricated among coarse herbage, or low bushes, it resembles the other species of the genus. If it be compared with *Neriene* *marginata*, it will be seen, immediately, how easy the transition is from the *Nerienæ* to the *Linyphiæ*.

Among the spiders captured on the continent, in the autumn of 1833, by Mr. Parke, were several specimens of *Linyphia marginata*.

Linyphia annulipes.

The cephalothorax is oval, prominent before, and glossy, with an indentation in the medial line of the posterior region; it is of a pale yellowish brown colour, with a fine line of black on each of the lateral margins, immediately above which is a longitudinal row of triangular, black spots, and along the middle extends a black band, bifid in front. The eyes are placed on black spots, their relative size and disposition being the same as in the other species of the genus. The mandibles are long, conical, armed with two rows of teeth on the inner surface, and inclined towards the pectus, which is heart-shaped, and of a pale yellowish brown colour. The maxillæ and lip have the same form as those of the *Linyphiæ* generally; their colour, and that of the mandibles, is yellowish brown, the maxillæ being the palest. The legs, which are long and slender, are provided with a few upright spines ; they are of a pale yellowish brown colour, with brownish black bands. Each tarsus has three claws at its extremity ; the two superior ones are pectinated about half their length, the terminal tooth being the longest, and the inferior one is inflected near its base, where there are one or two very minute teeth. The palpi have numerous, long, erect spines, particularly on their ultimate and penultimate joints, and are terminated by a single claw, slightly curved, and minutely dentated about a third of its length ; their colour is similar to that of the legs. The abdomen is oval, convex above, projecting over the base of the cephalothorax ; the upper part is of a greenish white colour, reticulated with fine, yellowish green, or greenish brown lines, and having along the middle a series of greenish brown bands of an angular form, whose vertices are directed forwards. A curved, black band, comprising four white spots in front, extends from the anterior part of the abdomen, contiguous to the cephalothorax, rather more than half its length along the sides, and from each of its extremities a black line stretches obliquely upwards and forwards; between the extremities of the curved band and the spinners are two, oblique, black streaks, united near the middle, and below the band and streaks are numerous, yellowish white spots. The inferior part of the abdomen is reddish brown, marked with a few, minute, yellowish white spots. A black streak occurs above the exterior margin of the spiracles, which are of a pale yellowish white colour. A long, depressed process of a red-brown colour, directed backwards, is in connexion with the sexual organs.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{6}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{12}$; length of an anterior leg $\frac{1}{3}$; length of a leg of the third pair $\frac{1}{5}$.

The male, though smaller than the female, resembles it in colour, and in the relative length of its legs, but the absolute length of those organs is greater, an anterior one measuring $\frac{2}{5}$ths of an inch. The third and fourth joints of the palpi are short, the latter, which is the stronger, being very convex on the outer side; the fifth joint is somewhat oval, with a pointed apophysis, curved outwards, near its articulation with the fourth joint; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, complex with spiny processes, the largest curving above the upper part of the fifth joint, and are of a red-brown colour.

I obtained specimens of this species in September, 1833, on the posts and rails of stages erected for the purpose of drying oak-bark, in the woods at Oakland.

Linyphia fuliginea.

The cephalothorax of the male is of an elongated oval form, having a large indentation in the medial line of the posterior region. The maxillæ are straight, and enlarged at their extremities. The lip is semicircular, and prominent at the apex. The mandibles are long, powerful, conical, armed with two rows of minute teeth on the inner surface, and inclined towards the pectus, which is heart-shaped. The colour of these parts is dark brownish black. The legs are long, slender, and of a light red-brown colour; the first pair is the longest, then the second, and the third pair is the shortest. Each tarsus is terminated by three claws; the two superior ones are pectinated about half their length, the last tooth of the series being the longest, and the inferior one is inflected near its base. The colour of the palpi is the same as that of the legs, with the exception of the ultimate and penultimate joints, which are brownish black, the third and fourth joints are short, the latter being much the stronger, particularly at its anterior extremity; the fifth joint is of an oblong oval figure, pointed at its termination; it is convex and hairy above, concave within, comprising the palpal organs, which are highly developed, complicated in structure, with a long, slender, prominent spine curved upwards and somewhat outwards in a circular form; they are of a brownish black colour, tinged with red. The abdomen is nearly cylindrical, and of a brownish black colour, with a white spot on each side of the medial line, on the upper part, near the cephalothorax. The plates of the spiracles are of a dark brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{3}{20}$ths of an inch; length of the cephalothorax $\frac{1}{12}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{22}$; length of an anterior leg $\frac{3}{10}$; length of a leg of the third pair $\frac{1}{5}$.

I procured specimens of this spider in the spring of 1833, in the woods at Oakland, but they were all males, and I have not yet discovered the female.

Linyphia pallidula.

In its more important external characters this spider resembles the other species belonging to the genus *Linyphia*. The cephalothorax is inversely heart-shaped, convex above, and glossy, with a large indentation in the posterior region; it is of a yellowish white colour, having a black band, contracted near the middle, extending along the medial line; the lateral margins are black, and a black spot occurs in front, between the bases of the mandibles. The eyes are placed on black spots. The mandibles are conical, perpendicular, armed with a red nail at the extremity, and a few red teeth on the inner surface; they are of a pale yellowish brown colour. The maxillæ are yellowish white, with the inner margin black, and a black spot on the exterior side. The lip is blackish at the base, and yellowish white at the apex. The pectus is heart-shaped; its colour is yellowish white, the borders excepted, which are black. The legs and palpi are long, slender, and moderately hairy; they are yellowish white, with numerous black bands. The abdomen is oval, remarkably convex above, projecting over the base of the cephalothorax; it is slightly hairy, and of a pale yellowish white colour, marked with black lines; a curved one, situated in front, and reaching to the sides, has its extremities enlarged; several short, longitudinal ones, whose extremities converge, but do not meet, (the first two excepted, which unite before in the curved, frontal line,) extend, in pairs, along the middle of the upper part, about half its length; between them and the spinners are two parallel series of oblique lines whose anterior extremities nearly touch; and a few lines, of an irregular figure, diverging laterally from those near the middle and posterior regions of the abdomen, extend to its sides: on the under part of the abdomen, immediately below its connexion with the cephalothorax, is a small, transverse, black streak; and in the middle two oblique, black lines occur, which almost unite near the spinners, but diverge widely and abruptly at their anterior extremities. The spinning mammulæ are of a yellowish brown colour; a pair of small, black spots is situated on each side of them, near their base, and a larger one, of a triangular form, underneath. The plates of the spiracles are whitish.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{6}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{11}$; length of an anterior leg $\frac{5}{12}$; length of a leg of the third pair $\frac{7}{24}$.

The male resembles the female in colour; but the palpi of the only specimen of this sex which I have seen were not fully developed, of course it had not attained maturity.

Mr. T. Blackwall captured this species at Oakland, in the summer of 1834.

Genus.........*Nephila*.........Leach.

Nephila Turneri.

I have seen the female only of this spider. Its cephalothorax is nearly quadrilateral, the major axis being in the direction of the abdomen; it is notched behind, and the posterior region is depressed, with a deep indentation in the medial line; the anterior part is rather narrower, and convex; the lateral margins are rough with minute tubercles, and two very conspicuous ones occur near its middle; the whole of the upper surface is black, thinly covered with short hairs of a silvery lustre. The eyes are disposed in two transverse rows on the anterior part of the cephalothorax; the four intermediate ones, which are seated on an eminence, form a square, the two in front being rather the largest of the eight, and the other four are in pairs, placed obliquely on abrupt tubercles, one on each side of the square. The mandibles are robust, conical, perpendicular, finished with teeth on the inner surface, and are black. The maxillæ are straight, powerful, and enlarged at their extremities, which are rounded. The lip is rather longer than broad, and subacuminated at the apex. These organs are black, the inner margins of the former, and the tip of the latter, being of a red-brown colour. The pectus is heart-shaped, with three pointed projections in front, two lateral, and one intermediate, the last situated immediately below the lip; its colour is yellow, finely bordered with black, an oblong black spot occupying the medial line of the posterior region, on each side of which is a smaller one, placed on the hinder part of a prominence contiguous to the insertion of each leg of the third pair. The legs are long, and without brushes, or tufts of hair; the first pair is the longest, then the second, the third pair being the shortest; they are black, the thighs excepted, which are yellow, with black extremities; the first joint of the tarsi is very long, and the last or terminal one remarkably short, comparatively; the two superior claws with which it is armed are pectinated about half their length from the base, and the inferior one is abruptly inflected near its articulation; each of the coxæ has a rounded, glossy protuberance on the under side, near its articulation with the pectus, those on the last pair being the largest, and those on the anterior pair the least apparent. The palpi, which are black, are terminated by a small claw, and some short, strong spines; the third joint is very short. The abdomen is long, somewhat cylindrical, projecting over the base of the cephalothorax, and is of a yellow-brown colour.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, 1 inch and $\frac{3}{20}$ths; length of the cephalothorax $\frac{1}{2}$; breadth $\frac{2}{5}$; length of an anterior leg $2\frac{3}{4}$; length of a leg of the third pair $1\frac{7}{20}$.

The specimen from which the foregoing description was taken is from the Gold Coast, Upper Guinea, on the western coast of Africa. It was obligingly submitted to my inspection by Mr. J. A. Turner, of Manchester, a zealous and skilful entomologist, in compliment to whom I have named the species.

Tribe.........*Laterigradæ*.........Latreille.
Genus........*Thomisus*............Walckenaër.

Thomisus erraticus.

The cephalothorax of the male is large, inversely heart-shaped, broadly truncated before, convex above, glossy, depressed in the anterior region, and has a slight indentation behind, in the medial line; it is of a red-brown colour, with blackish margins; a longitudinal, black streak extends from each lateral pair of eyes towards the abdomen, and between these streaks is a yellowish white band, bifid before; on the frontal margin are some strong, black bristles, directed forwards. The eyes are disposed in front, in two transverse, curved rows, forming a crescent; the lateral eyes of both rows are larger than the rest, those of the anterior row being the largest of all, and are seated on projections of the cephalothorax of a yellowish white colour. The mandibles are small, cuneiform, and vertical. The maxillæ are rather slender and incline towards the lip, which is triangular. The pectus is of an elongated heart-shape. These parts are red-brown. The first and second pairs of legs, which are much longer and more powerful than the third and fourth pairs, are nearly equal in length, the second pair being slightly the longer; and the fourth pair a little surpasses the third in longitudinal extent: the thighs and the superior joint of the tibiæ of the first two pairs are of a dark reddish brown colour, inclining to black above, the remaining portions of these limbs, and the whole of the third and fourth pairs, being of a pale red or yellowish brown colour. All the legs are provided with strong, sessile spines, particularly those of the first and second pairs. Each tarsus has two curved, deeply pectinated claws at its extremity. The second joint of the palpi is dark reddish brown; the third and fourth joints are short, and of a pale red-brown colour; the latter projects a pointed apophysis on the outer side, and another underneath, which has a small protuberance near its extremity; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, complicated in structure, with one or two strong, prominent, spiny processes near the upper part, and are of a dark red-brown colour. The abdomen is oval, somewhat depressed, and projects over the base of the cephalothorax; it is yellowish white above, with a broad, irregular, longitudinal band of a dark brown colour extending on each side of the medial line, nearly to the spinners, immediately above which organs are a few transverse, dark brown streaks, connecting the lateral bands; in the space comprised between the lateral bands are a short, longitudinal streak, directed backwards from the anterior part of the abdomen, and five indented spots, all of a dark brown colour; one of the spots occurs in the longitudinal streak, near its anterior extremity, and the other four are disposed in pairs, which form a square, on the sides of its posterior extremity; the sides and inferior surface of the abdomen, with the plates of the spiracles, are of a dark brown colour, the last being the palest.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{6}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{11}$; breadth of the abdomen $\frac{1}{12}$; length of a leg of the second pair $\frac{7}{24}$; length of a leg of the third pair $\frac{1}{5}$.

I have captured two specimens only of this species, both of which were males; one was taken on the turnpike-road near Capel Curig, in Caernarvonshire, in October, 1833; and the other on a foot-path in the township of Crumpsall, in June, 1834. This spider appears to belong to M. Walckenaër's fourth section of the genus *Thomisus*, or the *Cancroides*.

Tribe......*Citigradæ*......Latreille.

Genus, *Hecaërge.*

Eyes eight in number, unequal in size, disposed in two transverse rows on the anterior part of the cephalothorax; four, constituting the anterior row, which is slightly curved backwards, are adjacent and minute, the two lateral ones being the smallest of the eight; the posterior row is greatly curved, with its convexity directed forwards; it comprises the other four eyes, which are large, and separated by moderately wide intervals.

Maxillæ short, strong, convex on the under side, enlarged at the base, where the palpi are inserted, rounded at the extremities, and inclined towards the lip.

Lip small, as broad as long, triangular, truncated at the apex.

Legs powerful; the fourth pair is the longest, then the first, the third pair being the shortest.

The spiders belonging to this genus are erratic, taking their prey by surprise.

Hecaërge maculata.

(PLATE 3, fig. 8 and 9.)

The cephalothorax is oval, convex above, depressed in the posterior region, pointed before, and covered with short hairs; its colour is pale yellowish brown, with a broad dark brown band, extending along each side of the medial line, and two fine lines of the same hue on the lateral margins; a few longish, white hairs, directed forwards, occupy the space between the two intermediate pairs of eyes, and immediately below the anterior row of eyes is a small, transverse, parallel line of a dark red-brown colour. The mandibles are small, perpendicular, conical, armed with a curved, red nail at the extremity, and a few minute teeth on the inner surface; they are of a pale yellowish brown colour, with a dark brown, elongated spot in front of each, extending from the base towards the extremity; this spot is palest in the medial line. The maxillæ are pale yellowish brown. The lip is dark brown, bordered with pale brown. The pectus is heart-shaped, and of a pale yellow colour, faintly tinged with green; eight dark brown spots occur on its margins; one, which is very minute, and in some individuals wanting altogether, is situated opposite the lip; three are disposed on each side; and one is seated on its posterior extremity. The legs are hairy, and are furnished with strong spines; the thighs and terminal joint of the tarsi are pale yellowish brown, the former having two or three longitudinal lines of a dark brown colour on the upper and outer sides, which are most conspicuous on the first and second pairs, and some minute spots of the same tint underneath; the tibiæ and superior tarsal joint are dark brown, those of the first and second pairs of legs having a series of long, moveable, sessile spines on each side of the inferior part; there are two long, strongly curved claws at the extremity of the tarsi; each is provided with three minute teeth, the terminal one being the longest, and beneath them is a small brush, which apparatus enables the spider to ascend with facility smooth, perpendicular surfaces. The palpi are filiform, of a pale yellowish brown colour, and are provided with a few spines, two of which, on the under side of the fifth joint, are opposite and erect; a long, curved claw, having three exceedingly small teeth underneath, terminates each palpus. The abdomen, which is thickly covered with hair, is of an oval form, convex above, projecting over the base of the cephalothorax, and is broader at its posterior than its anterior extremity; the upper part is of a pale yellowish brown colour, mingled with white, and has three small tufts of white hair in front, near the cephalothorax; two narrow, obscure, brownish black streaks, one on each side of the medial line, extend from the anterior part of the abdomen almost a third of its length, and are followed by a series of brownish black spots, occupying the remainder of the medial line to the spinners, on each side of which is a longitudinal row of very small spots of the same hue; these streaks and spots are comprised between two irregular, brownish black bands, composed principally of spots, confluent or nearly so, diminishing in size as they approach the spinners; the sides and under part of the abdomen are pale yellowish brown, spotted with brownish black, the spots on the latter being minute. The plates of the spiracles are yellowish brown, with pale inner margins. The spinning mammulæ, which are small, do not differ remarkably in length. The young resemble the mother, but their colours are darker, and the brown bands and lines on the cephalothorax are broader.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{10}$; length of a posterior leg $\frac{3}{8}$; length of an anterior leg $\frac{3}{10}$; length of a leg of the third pair $\frac{1}{4}$.

The male, though smaller than the female, is similar to it in colour, and in the relative length of its legs. The third and fourth joints of the palpi are short, a small, pointed apophysis projecting from the outer side of the anterior extremity of the latter; the fifth joint is oval, convex and hairy above, concave beneath, comprising the palpal organs, which are highly developed, with a curved, spiny process extending to the termination of the joint, and are of a red-brown colour.

This species, which I discovered in the woods about Oakland, in Denbighshire, in the month of April, 1833, approximates most nearly, in its general structure, to the spiders of the genera *Lycosa* and *Dolomedes*; by the organization of the feet, however, it appears to connect the *Citigradæ* with the *Laterigradæ*. In the month of June the female constructs a lenticular cocoon of white silk, of a slight texture, measuring about $\frac{3}{10}$ths of an inch in diameter, which she usually attaches to the under side of a stone, depositing in it between twenty and thirty spherical eggs of a yellowish white colour, not agglutinated together.

Tribe........*Saltigradæ*, } ......Latreille.
Genus.......*Salticus*, }

Salticus sparsus.

The cephalothorax is large and nearly quadrilateral; it slopes abruptly in the posterior region, and the anterior part, which is prominent, projects beyond the mandibles; it is provided with black hairs above, interspersed with yellowish white ones, forming, in some specimens, an obscure spot between the posterior pair of eyes. The eyes, which are eight in number, and unequal in size, are disposed in three rows, constituting three sides of a square, in the front, and on the sides of the cephalothorax; the intermediate eyes of the frontal row are very large, and the intermediate eye of each lateral row is remarkably small. The legs are robust and hairy; they are black, with reddish brown bands, on which white hairs occur; the fourth pair is much the longest, and the first, second, and third pairs are nearly equal in length, the second pair being rather the shortest. The palpi are short, and mask the mandibles; they resemble the legs in colour, but the fourth and fifth joints are abundantly supplied with long, white hairs, which are employed by the spider as brushes to remove dust, or any extraneous matter, from the corneous coat of the anterior eyes. The mandibles are small, vertical, armed with a few minute teeth on the inner surface, near the extremity, and are of a dark reddish brown colour. The maxillæ, which are straight, are enlarged and rounded at the extremity. The lip is oval. These parts are dark brown, the apices being the palest. The pectus is oval, with a small prominence on each side of the anterior extremity; it is sparingly clad with white hairs, the margins being the most abundantly supplied with them, and is of a dark brown colour. Each tarsus has two long, curved, pectinated claws at its extremity; and beneath them is a brush or climbing apparatus. The abdomen is oval, somewhat depressed, pointed behind, and hairy, projecting over the base of the cephalothorax; it is brownish black above, blended with white; on each side of the medial line, rather nearer the posterior than the anterior extremity, is a conspicuous, irregular, white spot, between which and the spinners is a series of obscure, whitish lines of an angular form, whose vertices are directed forwards, and a white spot occurs on the coccyx; the sides are greyish, with a few white spots near the spinners; a tuft of white hairs occupies the anterior part, contiguous to the cephalothorax; the under side is grey, and the plates of the spiracles are brown.

Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{5}$th of an inch; length of the cephalothorax $\frac{1}{11}$; breadth $\frac{1}{14}$; breadth of the abdomen $\frac{1}{12}$; length of a posterior leg $\frac{1}{4}$; length of a leg of the second pair $\frac{1}{7}$.

The male resembles the female in colour, and in the relative length of its legs; but the abdomen is smaller in proportion to the size of the cephalothorax. The third and fourth joints of the palpi are short; the latter projects two obtuse apophyses from its anterior extremity, one situated in front, and the other, which is much the larger, on the outer side; the fifth joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, little complicated in structure, and are of a dark red-brown colour.

I first observed this species on the outer walls of Crumpsall Hall, in bright sunny weather, in the summer of 1828. It pairs in the month of May.

Salticus rufifrons.

The male of this species has the cephalothorax large and nearly quadrilateral, sloping abruptly behind; it projects in front beyond the mandibles, and on this prominence the anterior eyes are situated, which are surrounded by short, red hairs; it is of a dark brown colour, the margins being almost black, and is clad with orange-brown hairs, which are densest on the anterior part of the superior region. The intermediate eyes of the anterior row are greatly larger, and the intermediate eye of each lateral row is much smaller than the rest. The mandibles are small, vertical, and of a dark brown colour, with red-brown extremities. The maxillæ are strong, greatly enlarged at the extremities, and their colour is brown. The lip is small, oval, and of a dark brown colour. The pectus is oval; its colour is similar to that of the maxillæ, and it is provided with long, whitish hairs, which are most abundant on the margins. The legs are robust and hairy, particularly those of the anterior pair; the fourth pair is the longest, and the second pair is the shortest, the first and third pairs being equal in length; the third and fourth pairs are reddish brown; the colour of the second pair is the same, except that the under part of the femores and tibiæ, and of the superior joint of the tarsi is black, and the terminal joint of the tarsi is yellowish white; the anterior pair is black, the terminal joint of the tarsi excepted, which is white. Underneath the two claws at the extremity of each tarsus is a small, black brush or climbing apparatus. The second joint of the palpi is clavate, and brownish black, with some strong, black bristles at its anterior extremity; the third and fourth joints are short; their colour is pale yellowish brown, the latter having a dark red-brown spot in front; both are supplied with coarse, white hairs on the upper side, those on the fourth joint being the longer; the fifth joint is of a red-brown colour, with some long, coarse, white hairs on the upper part, towards the inner side; it is of an oval form, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, extending upwards to the articulation of the third and fourth joints, and have a slender, blackish spine, curved into a circular form, at the anterior extremity; they are of a pale flesh-colour. In a state of repose the palpi mask the mandibles, and the coarse, white hairs, with which they are provided, form an obtuse, curvilinear angle, whose vertex is directed downwards. The abdomen is oval, pointed behind, and somewhat depressed, projecting a little over the base of the cephalothorax; above it is hairy, and of a dark brown colour, mottled with yellowish brown, a series of obscure, angular lines, of the latter hue, whose vertices are directed forwards, and which diminish in lateral extent as they approach the spinners, occupying the medial line: the under side is glabrous, of a dark brown colour, and has two longitudinal, yellowish brown stripes on each side of the medial line. The plates of the spiracles are dark brown.

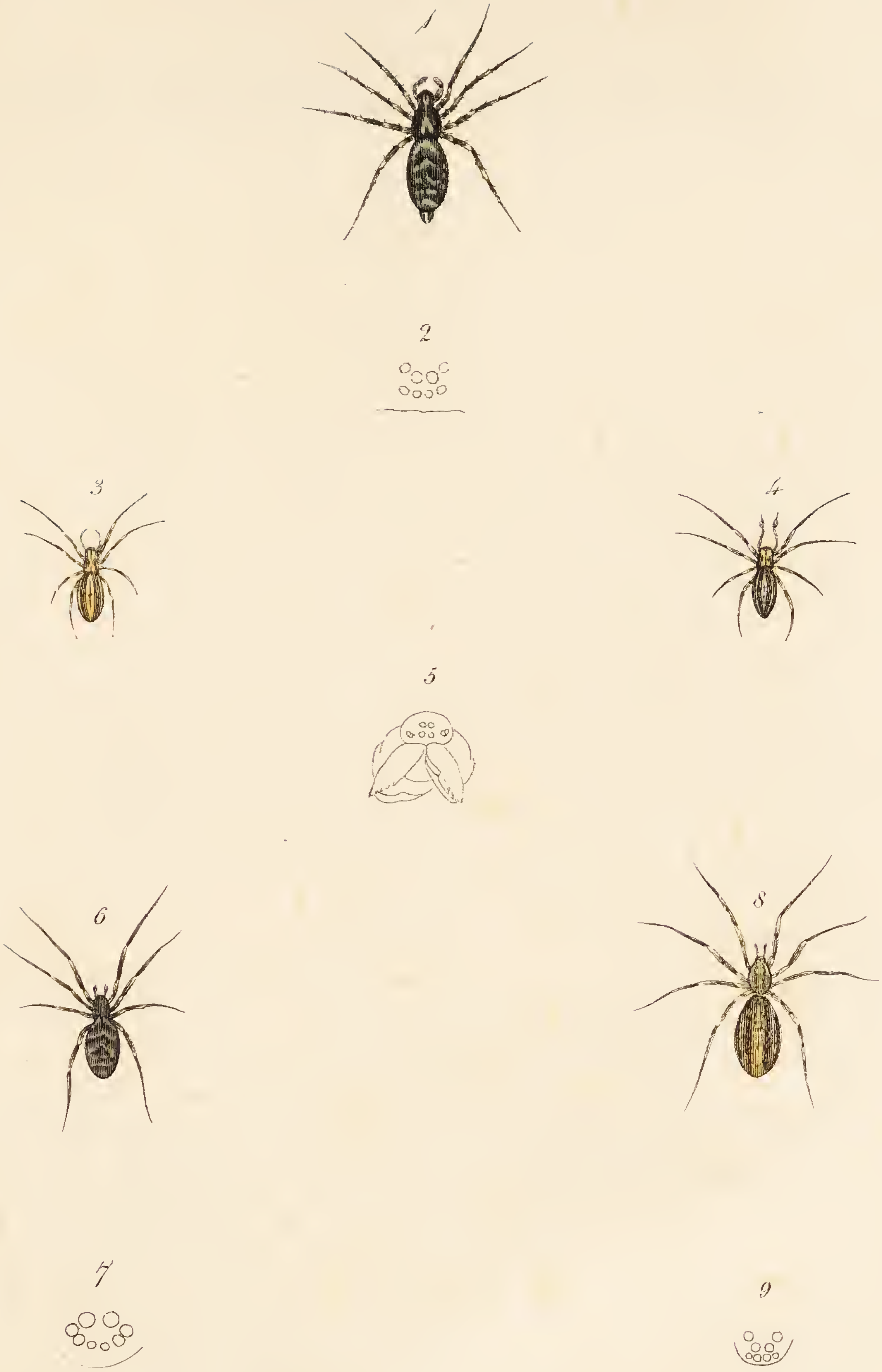
Length, from the anterior part of the cephalothorax to the extremity of the abdomen, $\frac{1}{7}$th of an inch; length of the cephalothorax $\frac{1}{14}$; breadth $\frac{1}{21}$; breadth of the abdomen $\frac{1}{21}$; length of a posterior leg $\frac{1}{6}$; length of a leg of the second pair $\frac{1}{9}$.

This spider has a close affinity with *Salticus sparsus*. I procured two specimens of it, both of them males, in May, 1832, on fragments of rock, in Gwydir woods, on the western side of the vale of Conway, North Wales; and in June, 1834, I captured the individual, from which the preceding description was taken, on the rails of a garden situated in the township of Cheetham.

Pl. 1

Pl. 2

Pl. 3



EXPLANATION OF THE PLATES.

PLATE 1.

FIG.

1. The tarsus of one of the posterior legs of *Clubiona atrox*, exhibiting the combing apparatus; *a*, the upper row of spines; *b*, the lower row of spines; *c*, the spur at the lower extremity of the apparatus.
2. The superior joint of the tarsus, highly magnified; *a*, the upper row of spines; *b*, the lower row of spines; *c*, the spur.
3. The foot of the right anterior leg of *Epeira Diadema*, exhibiting the claws.
4. A setaceous bristle from one of the tarsal brushes of *Mygale Avicularia*.
5. A compound hair from a leg of *Aranea civilis*.

PLATE 2.

1. Male of *Savignia frontata*.
2. Lateral view of the cephalothorax of the male of *Savignia frontata*, with the legs and palpi detached.
3. Male of *Walckenaëria acuminata*.
4. Lateral view of the cephalothorax of the male of *Walckenaëria acuminata*, with the legs and palpi detached.
5. Female of *Walckenaëria acuminata*.
6. Lateral view of the cephalothorax of the female of *Walckenaëria acuminata*.
7. Male of *Walckenaëria cristata*.

FIG.

8. Lateral view of the cephalothorax of the male of *Walckenaëria cristata.*
9. Female of *Walckenaëria cristata.*
10. Lateral view of the cephalothorax of the female of *Walckenaëria cristata.*
11. Lateral view of the cephalothorax of the male of *Walckenaëria cuspidata.*

PLATE 3.

1. Female of *Textrix agilis.*
2. Eyes of *Textrix agilis*, exhibiting their relative size and disposition.
3. Female of *Manduculus ambiguus.*
4. Male of *Manduculus ambiguus.*
5. Front view of the cephalothorax of the male of *Manduculus ambiguus*, with the palpi detached, exhibiting the disposition of the eyes and the structure of the mandibles.
6. Female of *Neriene marginata.*
7. Eyes of *Neriene marginata*, exhibiting their relative size and disposition.
8. Female of *Hecaërge maculata.*
9. Eyes of *Hecaërge maculata*, exhibiting their relative size and disposition.

Figures 3 and 4, Plate 3, are of the natural size; all the others are more or less magnified.

I am indebted to Mr. JOHN PARRY, of Manchester, for superintending the execution of the plates, and for the drawings from which they were engraved.

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J. PIGOT AND SON, PRINTERS, MANCHESTER.